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THE MILITARY AND NAVAL POLICY OF THE UNITED STATES.

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THE failure of the American people to profit by the lessons of costly experience has made the military history of the United States a record of blunder and extravagance. Satisfied with the successful termination which their boundless resources have enabled them to give to each war, they do not often consider the exorbitant price in blood and treasure that they have paid for victory; and, salving their wounded vanity with the balm of final triumph, they close their eyes to the blots which a want of warlike preparation has placed upon the national banner.

The most prominent features of the military policy of the United States are a parsimonious and inadequate provision, in time of peace, for the necessities of war; an injudicious reliance upon raw troops; and a mischievous intermeddling by civil officials with the conduct of military operations. These features occur with amazing pertinacity in our national annals, in spite of the warnings of bitter experience.

THE REVOLUTIONARY PERIOD.

The Revolution taught many lessons that would have been of the greatest value to the Young Republic, if they had been remembered, or even heeded at the time. In the dark days preceding the battle of Trenton, in the midst of "the times that

tried men's souls," Washington urged Congress to raise a permanent army, and abandon all reliance upon militia, "except in cases of extraordinary exigency." Remembering the conduct of undisciplined troops at the battles of Long Island and White Plains, and speaking with the earnestness of a commander whose cause and reputation were in jeopardy, he said: "Experience, which is the best criterion to work by, so fully, clearly, and decisively reprobates the practice of trusting to militia, that no man who regards order, regularity, and economy, or his own honor, character, or peace of mind, will risk them upon this issue. The evils to be apprehended from a standing army are remote, and, situated as we are, not at all to be dreaded; but the consequence of wanting one is certain and inevitable ruin. This contest is not likely to be the work of a day; and to carry on the war systematically, you must establish your army upon a permanent footing."[1]

The emergency required prompt action; and Washington, finding his force reduced to three thousand men, and observing that the calls of the Governor of New Jersey upon the colonels of militia failed to put one full company in the field,[2] ordered three battalions of artillery to be immediately recruited, and in justification of his action said: "The present exigency will not admit of delay, either in the council or the field. Ten days more will put an end to the existence of this army. . . . Short enlistments and a mistaken dependence upon militia have been the origin of all our misfortunes and of the great accumulation of our debt. Militia may possibly check the progress of the enemy for a little while, but in a little while the militia of those States which have been frequently called upon will not turn out at all, or will do it with so much reluctance and sloth as to amount to the same thing.

"These are the men I am to depend upon ten days hence; this is the basis on which your cause must forever depend till you get a standing army sufficient of itself to oppose the enemy."[3]

Frightened into common sense by impending danger, Congress authorized, in addition to the eighty-eight battalions to be furnished by the separate States, the raising of sixteen battalions of infantry, three thousand light horsemen, three regiments of artillery, and a corps of engineers, to be enlisted indiscriminately from all the States.[4] Thus was formed a small national force,

which existed as such only until the following year, when the successes of the American arms enabled Congress to turn from a dread of the enemy to a jealousy of its own army. The curse of "State sovereignty" was upon Congress; and a fear of centralization caused that body to give to each State not only the exclusive power over its militia, but the power of appointing all regimental officers in its quota of troops for the general service.[5]

The policy of Congress was at total variance with that of Washington. Though the latter had continually urged the enlistment of the troops "for the war," an exaggerated fear that the Army, though composed of patriotic citizens, might be prejudicial to popular liberty, caused the former to insist upon short enlistments. Washington advocated the formation of a national army; Congress preferred that there should be a confederated "army of thirteen sovereignties." The commander-in-chief objected to the employment of ill-disciplined troops; Congress placed an almost suicidal reliance upon raw levies, and, though sadly deficient in funds, wasted upon an ever-changing army an amount of money that would have sufficed for the maintenance of an efficient permanent force.

Long after the alliance with France, and within a year of the final triumph at Yorktown, Washington wrote to his friend George Mason:

"Our present distresses are so great and complicated, that it is scarcely within the power of description to give an adequate idea of them. With regard to our future prospects, unless there is a material change both in our civil and military policy, it will be in vain to contend much longer.

"We are without money; without provision and forage, except what is taken by impress; without clothing, and shortly shall be, in a manner, without men. In a word, we have lived upon expedients until we can live no longer. The history of this war is a history of temporary devices instead of a system, and economy which results from it.

"If we mean to continue our struggles (and it is to be hoped that we shall not relinquish our claims), we must do it upon an entire new plan. We must have a permanent force; not a force that is constantly fluctuating and sliding from under us, as a pedestal of ice would leave a statue on a summer's day, involving us in expense that baffles all calculation—an expense which no funds are equal to."[6]

The events of the war were a practical proof of the soundness of Washington's views. It is not pleasant, even at the present day, to read of the inefficiency and cowardice of the American militia at Brandywine, Germantown, Camden, Cowpens, and Guilford Court-House, though an excuse for their conduct is easily found in their lack of discipline. A gratifying contrast is furnished by the gallantry of the Continental troops, who, in the same battles demonstrated their ability to contend on equal terms with the best soldiers of the British army. Lexington, Bunker Hill, and Bennington were the only battles of the war in which the militia performed really good service. In the first they conducted a successful "bushwhacking" fight against an inferior force of British soldiers; in the second they had the advantage of a strong, fortified position; in the third they had overwhelming numbers in their favor, and then conquered only when a scarcity of ammunition caused the Hessian fire to slacken.[7]

Though not organized as Washington desired, the Continentals were national in spirit, and were regular troops in fact. By them the American cause was won. More than once they saved the day when disaster was following upon the heels of the fleeing militia. Steadfast and reliable, they were living proofs of the value of discipline; and they patiently endured hardship and suffering, one tenth of which would have sufficed to drive a European army to mutiny.[8] The history of the Revolution compels the conclusion that if the American armies had been composed exclusively of Continentals, the British would have met with irretrievable disasters from the unaided forces of the colonies; and that if reliance had been placed upon militia alone, not even an alliance with France could have saved the United States from conquest.

Upon the return of peace the lessons of the Revolution were quickly forgotten; and no provision was made to avoid in future wars the costly errors of the past. In 1784 the national army consisted of eighty men, including officers.[9] This was hardly more than a police force for the protection of military stores at West Point and Pittsburgh; and the defence of the Canadian and Western frontiers was left to the militia of the several States.

THE FIRST REGULAR ARMY.

In 1790 the first regular army organized after the adoption of the Constitution consisted of 1,216 men.[10] Even this

petty force, scattered along the extended Western frontier, was characterized by certain politicians as a menace to liberty —an accusation which it shared with the patriotic veterans composing the Order of the Cincinnati.[11] After Harmer's defeat, in the following year, by the Indians of the Northwest—a battle which furnished another proof of the inefficiency of militia,[12]—the prating of demagogues was silenced by the demands of necessity, and the pigmy army was increased to 2,128 men.[13] In the following year occurred another disastrous Indian campaign, in which St. Clair's force consisted principally of militia and raw levies. The defeat was caused by a panic of the militia, the small force of regulars alone making a determined resistance to the onslaught of the enemy.[14] To meet the exigencies of Indian warfare, the regular army was now augmented to about 6,000 men.[15] With a force consisting of 2,000 regulars and 1,100 mounted riflemen, who had been in military service long enough to become well disciplined, Wayne terminated the Indian war by a single decisive blow.[16] In 1796, peace having been restored on the Northwestern frontier, the Army was reduced to 2,800 men.[17]

The Army seems to have been regarded not as a nucleus around which volunteers could rally in times of national danger—not as a school in which officers could be trained in time of peace for the duties of war—but merely as a national police force; to be created when the Indians became troublesome, and to be disbanded, in great part, when the savages became quiet. This narrow view of the object of maintaining a regular army has not yet been wholly eradicated from the minds of American statesmen, and it has been the source of much unwise legislation.

In 1798 the threatened war with France caused a nominal increase of the Army to 13,000 men; but only 3,400 were actually enlisted.[18] In 1799 Congress authorized the President, in case war should occur with France, to increase the regular army by the addition of twenty-four regiments of infantry, three regiments of cavalry, a regiment and a battalion of riflemen, and a battalion of artillery; also to raise 78,000 volunteers.[19] This was a "war measure" which subsequent events rendered it unnecessary to carry out; but it is worth noting, as a contrast with the puerile steps taken by Jefferson and his followers at a period of more imminent danger.

While the Army, at the close of the Revolution, was reduced

to a petty police force, the reduction of the Navy was carried to the extent of annihilation. The vessels of war which, under such commanders as Paul Jones and John Barry, had successfully fought the ships of Great Britain, were all sold, except one line-of-battle ship, which was presented to the King of France. In the language of Cooper: "The Navy of the Revolution, like its Army, was disbanded at the termination of the struggle, literally leaving nothing behind it but the recollections of its services and sufferings."[20]

In his second message to Congress, Washington warned that body that preparation for war is the surest means of preserving peace; and he early advocated the creation of a navy. Yet nothing was done until the piratical acts of the Algerines made the want of a navy manifest. In 1794 Congress authorized the construction of six frigates, three of which were to be forty-fours.[21] Under this authority, the *Constellation*, *Constitution*, and *United States* were begun; but work on these vessels was suspended when the United States purchased peace of the Bey of Algiers at a cost of about a million dollars—"a sum quite sufficient," says Cooper, "to have kept the barbarian's port hermetically blockaded until he should have humbly sued for permission to send a craft to sea."[22]

The fear of war with France, which, in 1798, increased the Army "on paper," gave a more genuine augmentation to the Navy. The three frigates above mentioned were completed and launched; and the President was authorized to hire or purchase twelve vessels, not to carry more than twenty-two guns each.[23] The completion of the three remaining frigates provided for by the act of 1794 was decreed by Congress, and the number of vessels in the Navy was increased to twenty-four, comprising six frigates, twelve sloops-of-war, and six smaller vessels.[24] The President was also authorized to accept several vessels of war, which were contributed by the merchants of New York, Philadelphia, Baltimore, and the New England seaports, and to issue six-per-cent. stock to indemnify the subscribers.[25] In 1799 Congress appropriated a million dollars towards the construction of six ships-of-the-line and six sloops, $200,000 for the purchase of timber, and $50,000 towards the establishment of two dock-yards.[26] In the same year several vessels were bought and converted into men-of-war; and large appropriations for the increase of the Navy were continued until the end of Adams' administration.

At the close of the year 1799, the United States possessed a navy of thirty-five vessels, aggregating 894 guns,[27] and had taken such steps towards raising an army as to demonstrate the willingness and ability of the Nation to defend itself from aggression.

This wise policy was not destined to continue. With the inauguration of Jefferson a reign of parsimony was ushered in; and the energetic measures of the Adams administration were followed by short-sighted legislation based upon false economy. Notwithstanding the danger of serious complications with England, no new vessels were begun; the Army was reduced to 3,000 men; the sea-coast fortifications were neglected; the frames of the ships-of-the-line were broken up; and with a contemptible affectation of economy, the timber in the dock-yards was sold. The number of vessels in the Navy was reduced to thirteen, of which only six were kept in commission.[28] When the Tripolitan war necessitated an increase of the naval force, four small cruisers, of sixteen guns each, at a total cost of $96,000, were provided for the blockade of Tripoli.[29] Two similar cruisers were afterwards added to the blockading force, which was eked out by borrowing two bomb-ketches and several gun-boats from the King of Naples.[30]

In regard to the national defences, a strange fatuity seems to have seized the mind of Jefferson. The danger of war was imminent, yet he opposed any increase of the Army. Ignoring the fact that one of the prime uses of a regular force is to offer resistance to the enemy while the citizen soldiery is forming and receiving instruction, he strangely reversed the matter, saying: "The only force that can be ready at every point, and competent to oppose them [the enemy] is the body of neighboring citizens, as formed into a militia. Of these, collected from the parts most convenient, in numbers proportioned to the invading force, it is best to rely, not only to meet the first attack, but if it threatens to be permanent, to maintain the defence until regulars may be employed to relieve them."[31] Instead of favoring the increase of the Army, rendered necessary by the extension of the Western frontier caused by the acquisition of Louisiana, he gravely proposed to establish a commerce so advantageous to the Indians, "and only not losing to us," that self-interest would convert the savages into protectors of the white settlers, and render the Army unnecessary![32] Appreciating the necessity of protecting the sea-coast cities, he was appalled by the expense

required to fortify them. While complaining of the annoyance and oppression of American citizens, caused by foreign armed ships hovering on the coasts and harbors of the United States, he did not propose any increase even in the number of sailors in the Navy; but recommended such a reduction in the number of frigates that the limited *personnel* would admit of a full crew for each vessel.[33]

Congress shared in the timid views of Jefferson, and a compromise between the all-pervading spirit of parsimony and the necessity of making some preparation for national defence, resulted in the erection of a few land batteries in the principal harbors, and the construction of a fleet of gun-boats, each carrying one gun, which were to be laid up under sheds in time of peace, and manned by militia in time of war.[34] The naval estimates had been reduced to $250,000 a year[35]; and this amonut was chiefly frittered away in the construction of these small vessels, which cost $10,000 each.[36] In this manner $1,880,000 was expended in gun-boats[37]; and the money might as well have been literally thrown into the sea.

But even the Utopian views and the niggardliness of Jefferson and his followers could not wholly resist the demands of patriotism and common sense. The outrage upon the *Chesapeake*, and the failure of the embargo to produce any appreciable effects, resulted, in 1808, in the increase of the Army by 6,000 men,[38] and the expenditure of $1,014,702 upon sea-coast fortifications[39]; but the Navy was neglected.

While the national defences were provided for in this negligent and insufficient manner, great attention was paid to the reduction of the public debt; and in Jefferson's administration more than $26,000,000 of the principal of the national debt was extinguished.[40] This apparently happy financial result was, unfortunately, eventually overwhelmed by the expense arising from the false economy by which it had been gained.

ESTABLISHMENT OF THE MILITARY ACADEMY.

Notwithstanding the general imbecility that characterized the military and naval measures of Jefferson's administration, it was marked by one of the soundest strokes of military policy ever made by Congress—the establishment of the Military Academy at West Point. Recommended earnestly by Washington, and opposed on constitutional grounds by Jefferson, the project of

founding a national military school eventually found favor with the latter, and took practical shape in 1802; but it was not until 1812 that it ceased to be a mere adjunct of the engineer corps, and was organized on a sound basis.[41] Though established too late to make its influence felt in the War of 1812, the Military Academy has since repaid a thousand-fold, in time of war, the cost of its maintenance in time of peace; and the names of its alumni are conspicuously written on the most glorious pages of American history.

The administration of Madison was practically a continuation of that of his predecessor; and Jeffersonian parsimony continued to shape the military and naval policy of the nation. In 1809 the *personnel* of the Navy was increased to about 7,000 officers and men, and four frigates were ordered equipped for sea service[42]; but no new vessels were constructed. War with Great Britain was imminent; but almost no preparation was made for meeting it. The fortifications authorized in 1808 were carried slowly towards completion, the Army was increased by 4,000 additional men, and public money continued to be wasted upon gun-boats. Beyond these measures nothing was done; and finally, though war had long been threatened, the United States, with a navy of seventeen vessels and an army of 10,000 men (nearly half of whom were raw recruits), plunged recklessly into hostilities with the most powerful nation in the world.[43]

The Navy was small, but excellent; the Army was small and inefficient. It had been regarded as but little more than a national police force in time of peace, and now it was without power of expansion, and was practically destitute of staff and supply departments. Besides the duties properly pertaining to his office, the Secretary of War had to perform those of quartermaster-general, commissary-general, chief of ordnance, and many duties now belonging to the Secretary of the Interior.[44] It was truly said that the organization of the War Department was so deplorably wretched that "it was impossible to begin the war or to conduct it." The several staff corps, neglected until the very eve of the war, had to be created in haste, and organized, as it were, under fire. No distinct department of subsistence was created; and it was with the greatest difficulty that the petty forces on the Canadian border were supplied with rations.[45] The management of the supply departments, in general, was beneath contempt. At the siege of Fort Meigs, Harrison's sup-

ply of artillery ammunition was so limited that he was obliged to collect and re-use the cannon-balls that were fired at him by the enemy.[46] The delay in issuing flints to them caused the absence of a body of Virginia militia from the battle of Bladensburg.[47] The Kentucky troops, *en route* to New Orleans, were dependent upon the pledged credit of individual citizens for their transportation and supplies.[48] When New Orleans was first menaced, Jackson called for a supply of arms from the arsenal at Pittsburgh; but economy shuddered at the thought of paying the freight demanded by the only steamer then on the Mississippi, and the arms were shipped on keel boats, which landed them safely at New Orleans after the battle was ended.[49] Many of the Americans were without arms; and even the muskets on hand would have been useless had not the pirate Lafitte supplied Jackson with flints.

The whole war was a chaos of bad management. The regular army received an augmentation of 25,000 men[50]; but the increase came in the form of raw organizations, commanded, as a rule, by officers who knew nothing of the profession of arms. Henry Dearborn was transferred from collector of the port of Boston into the senior major-general of the Army. The other major-general was Thomas Pinckney, ex-member of Congress from South Carolina. Of the eleven brigadier-generals, only four were regular officers, three of whom were placed at the heads of the newly created staff departments; the other seven included two governors and a recently returned minister to France.[51] The Army was commanded by politicians; and, in utter oblivion of the lessons of the Revolution, the chief reliance was placed upon the militia. The total number of soldiers called into service exceeded half a million; the militia force alone amounting to 458,463 men.[52] Nevertheless, the record of the war shows only three battles in which the Americans had 5,000 men.

The unheeded lessons of the past were again taught by bitter experience. Hull's army was mainly composed of militia, who gave a practical proof of their inefficiency by being disgracefully beaten in an affair with an inferior force of British and Indians[53]; and a shameful surrender terminated a campaign in which the imbecile timidity of the American general was scarcely more conspicuous than the insubordination and worthlessness of his troops. At Queenstown and Sackett's Harbor the militia covered the American arms with any thing but glory; but the crowning humiliation was at Bladensburg, where nearly 7,000 Americans,

mostly militia, were easily routed by 4,000 British,[54] who then captured and burned the capital of a nation of eight million inhabitants.

VOLUNTEERS OF 1812.

The deeds of the regulars and United States volunteers at Chippewa, Lundy's Lane, and Fort Erie, where they defeated superior numbers of Wellington's Peninsular veterans, form a brilliant contrast to the monotonous record of militia disaster. Of all the humiliating reverses of the War of 1812, there was not one that was not due to the employment of militia; and excepting the conduct of a few raw recruits who fled with the militia at Bladensburg,[55] the history of that conflict does not furnish a single instance of any but the most gallant conduct on the part of the American regulars and disciplined volunteers. In only two battles did the militia conduct themselves with credit. At the Thames, Harrison's army of more than 3,000 men, composed chiefly of Kentucky militia, gained a victory over 2,000 British and Indians.[56] At New Orleans four fifths of Jackson's army consisted of militia; but this militia was composed of Western riflemen, with a sprinkling of Baratarian pirates. They held a strong, intrenched position, and their artillery was served by regular troops. Even then the great victory was qualified by the defeat of the militia, on the right bank of the river, by an inferior force of British.[57]

The evils resulting from the inexperience of the American generals were aggravated by the intermeddling of civil officials. In opposition to the advice of the Secretary of War, Winder was placed in command of the forces assembled for the defence of Washington; and the changes made by the *Secretary of State* in the disposition of the troops on the field of battle, contributed not a little to the shameful disaster of Bladensburg.[58]

As the war progressed the Americans began to profit by their hard experience. The increase of the regular army to 66,000 men was authorized,[59] and United States volunteers began to replace the militia. Though crudely organized, and numbering but little more than 10,000[60] men, these volunteers served with great credit, and were a worthy prototype of the volunteers of later days.

THE NAVY OF 1812.

The record of the United States Navy during the War of 1812 furnishes a more gratifying subject for the contemplation of an

American than the story of the campaigns on land. Yet, notwithstanding our early and brilliant successes at sea, the Navy was sadly neglected, and some of our best vessels, under such men as Decatur and Perry, were eventually so closely blockaded in our own ports by the superior force of the enemy as to be unable to get to sea. No steps were taken to increase the Navy until 1813, in which year Congress authorized the construction of four ships-of-the-line, six frigates, six sloops, and "as many vessels on the lakes as the public service might require."[65] The vessels needed for service on the lakes were speedily built; but the others were completed so late in 1814 as to be of no appreciable value in affecting the result of the war.[66] Throughout the entire conflict the inefficiency of the gun-boats was manifest, and the principal flotilla was burned to keep it from falling into the hands of the British when they ascended the Patuxent.[67]

Let us now consider the effects of the economy of Jefferson and his successor and disciple. The cost of the first six frigates being $1,288,888,[68] it is evident that the amount thrown away in the construction of gun-boats would have been more than enough to build eight frigates. These, with the vessels purchased or built during the administration of Adams, would have given to the United States a navy aggregating forty-three vessels and more than 1,200 guns. This force would have comprised twenty-two frigates, fifteen sloops-of-war, and six smaller vessels. The cost of six ships-of-the-line would have been $1,998,000[69]; but as the frames had already been built, the sum required for their completion would have been much less. It is plain, then, that if the money actually expended in naval construction had been wisely applied, a trifling additional expense would have sufficed to increase the Navy to six ships-of-the-line, twenty-two frigates, and fifteen sloops-of-war, besides a number of smaller vessels—a force, in fact, sufficient to prevent the blockade of our coast, and work great damage to the enemy; for, until the termination of the war in Europe, the largest naval force that Great Britain was able to send against the United States, was the fleet under Admiral Warren, which consisted of six ships-of-the-line, thirteen frigates, and eighteen sloops-of-war.[70]

The reduction of the national debt from $83,038,050, in 1801, to $45,209,737, in 1812,[71] was one consequence of the Jeffersonian policy of economy; another result was a war, which cost $100,000,000 and 30,000 lives, besides the inestimable losses caused by

the paralysis of commerce and industry." This conflict could probably have been avoided by making a fair degree of warlike preparation; for Great Britain was then engaged in her great struggle with Napoleon; and she would, doubtless, have made many concessions before giving cause for war to any well-prepared foe. When Talleyrand said that France had nothing to fear from a nation of debaters that had been trying for three years to build three frigates," he only expressed the contempt for American power that was felt by European nations—a contempt which was a prime cause of the English aggressions that led to war.

Even if the War of 1812 could not have been prevented by any measures of defence, it is certain that a proper degree of military and naval preparation would have saved the American people from the humiliation of losing their capital, and the disgrace of seeing a portion of Maine held as a conquered province until the close of the war. It would have enabled them to score a succession of brilliant victories at sea, to conquer Canada, and to avoid the necessity of signing a treaty of peace, which ignored the very cause for which they took up arms.

LESSONS OF THE WAR OF 1812.

The lessons of the war were not all ignored; and the messages of President Madison furnish a curious illustration of the progress of his education in the principles of a true military policy. In his inaugural address and earlier messages to Congress, his reliance upon militia and aversion to a regular army are strongly marked. The change in his views, as shown in subsequent messages, is equally evident; and in the message of February 18, 1815, officially announcing to Congress the termination of the war, he uses the following language, which should be heeded by the national law-makers of the present day:

"Experience has taught us that neither the pacific dispositions of the American people nor the pacific character of their political institutions, can altogether exempt them from that strife which appears, beyond the ordinary lot of nations, to be incident to the actual period of the world; and the same faithful monitor demonstrates that a certain degree of preparation for war is not only indispensable to avert disaster in the outset, but affords also the best security for the continuance of peace. The wisdom of Congress will, therefore, I am confident, provide for the maintenance of an adequate regular force; for the gradual

advancement of the naval establishment; for improving all the means of harbor defence; for adding discipline to the distinguished bravery of the militia; and for cultivating the military art, in its essential branches, under the liberal patronage of government."

In the main, the advice of Madison was followed. Though the military establishment was fixed at 10,000 men, instead of 20,000, as recommended by him,[70] it was no longer a mere national police force. It was an army, provided with staff departments; and it was now properly regarded as a nucleus around which volunteers might gather in time of national danger, and an institution in which a knowledge of the art of war would be preserved while the people generally were engaged in peaceful vocations. Measures were taken for the protection of the sea-coast and lake frontier; and within the next few years strong fortifications were begun for the defence of the principal maritime cities. The Navy received hearty support from Congress, and an annual appropriation of a million dollars was made for its increase.[71] As a result the Navy rapidly grew in strength and efficiency; and, vessel for vessel, it was, probably, superior to any other navy in the world.

But, under the influence of profound peace, the experience of war was soon forgotten. In 1821 the Army was reduced to 6,000 men,[72] and some of the most faithful military servants of the nation were discharged. John Quincy Adams writes in his diary: "The President has determined to appoint General Jackson governor of the whole Territory [Florida], and wrote to inform him of it directly. The reduction of the Army by the act of Congress passed at their recent session commences on the first of June next. It leaves only one major-general and two brigadiers. Brown, as the eldest commissioned of the two major-generals, is to be retained, and Scott and Gaines are to be the two brigadiers. Jackson, therefore, from the first of June, will be out of the military service, and this office of governor of Florida presented itself as a fortunate occasion to save the nation from the disgrace of even appearing to discard without compunction a man to whom it is so deeply indebted."[73] The dismal results of having such failures as Hull, Dearborn, Wilkinson, and Hampton in high command were forgotten; and, in a yearning for economy, the general whose skill and bravery had cast a much-needed halo of success around the last moments of the war was discharged from the military service.

The economical measures of Congress did not fall upon the Army alone. The Navy also felt the effects of the spirit of retrenchment; the annual appropriation for its increase being reduced to $500,000.[74] In 1829 President Jackson recommended the total cessation of the construction of ships-of-the-line and frigates, and the limitation of our naval policy to the object of protecting our commerce.[75] The recommendation was acted upon; and the next message of Jackson announced that the attention of the Government had been directed more to preserving the vessels already built than to increasing their number.

The necessity of preparing, in time of peace, for national defence was thus quickly forgotten by the American people. In 1835, the failure of France to pay the indemnities stipulated by the treaty of 1831, and the measures of reprisal recommended to Congress by President Jackson, caused a war cloud to appear; and the United States was, of course, found sadly lacking in warlike preparation. Notwithstanding the danger of war, and the fact that the debt had been completely extinguished, the Senate refused to give its sanction to a bill which had passed the House of Representatives, appropriating $3,000,000, to be expended by the President, during the recess of Congress, in such military and naval preparations as he might deem necessary.[76] Before Congress again met, a French fleet of observation, consisting of sixty vessels of war, was ordered to the West Indies. It was declared in the French Chambers that "France knew the way to Washington as well as England did"; and the Paris *Constitutionnel* exultingly pointed to the feeble means of defence with which America would have to oppose the formidable fleet of Admiral Mackau.[77] During the next session of Congress,—senators were engaged in disclaiming their responsibility for the neglect of the national defences,[78] and vigorous measures of warlike preparation were authorized; but the friendly offer of English mediation and the peaceable foreign policy of Louis Philippe combined to save the United States from a war for which it was lamentably unprepared. The narrow escape from war stimulated the interest of Congress in the Navy; and in five years (after the danger was past) the naval force in commission had been nearly doubled.[79]

THE FLORIDA WAR.

The long period of peace from 1815 to 1846 was broken only by Indian wars, one of which, the Seminole War, was, however,

of sufficient magnitude to necessitate the employment, at one time or another, of every regiment in the regular service (including two new regiments of dragoons), and more than twenty thousand volunteers and militia, who enlisted for terms varying from three months to one year.[80] The expenses of the war amounted to more than $19,000,000, exclusive of the expenditures pertaining to the regular army.[81] The raw levies called out were almost invariably inefficient, and were uniformly costly. The cost of maintaining the militia was more than double that of keeping an equal number of regular soldiers, without taking into consideration the great loss and destruction of military stores and public property inseparable from the employment of undisciplined troops in active service.[82] In return for this expense, the militia rendered no service of appreciable value. The expense and duration of the Seminole War are attributable to the short service and poor discipline of the greater part of the American troops, quite as much as to the nature of the country in which they were operating.

The Seminole War showed clearly that true economy required at least a sufficient force of regular soldiers to conduct campaigns against Indians; but the hostilities in Florida had hardly ceased when the question of army reduction came up in Congress. The disbanding of the Second Dragoons was proposed and warmly debated. Much was said about the danger of maintaining standing armies in a republic; more was said about economy. Finally it was determined to retain the regiment in the military service; but, as a measure of economy, it was decided that it should be dismounted, and serve on foot as a regiment of riflemen.[83] As a result of this remarkable straining after economy, a regiment that had been mounted while serving in the "hammocks" and everglades of Florida was sent to oppose on foot the savage horsemen of the Far West. The regiment was not again mounted until shortly before the Mexican War. The Seminole War is remarkable as the last of our conflicts in which militia soldiers formed more than an insignificant portion of our armies.

THE MEXICAN WAR.

The Mexican War, the most brilliant conflict ever engaged in by the United States, was a succession of American victories, from Palo Alto to the City of Mexico. While much of this success was, doubtless, due to the innate superiority of the Anglo-

Saxon-American over his mongrel opponent, still more is to be attributed to the organization of the American Army. The regular force, which, under the exigencies of Indian warfare, had grown to eight regiments of infantry, two of dragoons, and four of artillery, was increased to 26,992 men,[84] and 75,000 volunteers were mustered into the military service.[85] These volunteers were governed by the regulations and articles of war under which the regular army served, and speedily became regulars in every thing but name.

Yet, notwithstanding the excellence of the American soldiers and the brilliant generalship of their commanders, the history of the conflict with Mexico is blotted with some of the blunders ever attendant upon the wars of the United States. The force with which Taylor opened the war was too small to enable him promptly to follow up his first victories. Reinforcements for Scott's army were drawn from his small command, until he was left with a mere handful of men to meet Santa Anna's attack at Buena Vista. Though the American armies aggregated more than 100,000 men, Scott was left without proper reinforcements, and the Army with which he captured the City of Mexico was a mere "forlorn hope" of less than 11,000 soldiers. The baneful effects of political intermeddling were felt, and the Army barely escaped losing its great commander before the campaign was begun. The long and brilliant service of Winfield Scott was ignored by President Polk, who wished to confer upon Thomas H. Benton the command of the armies and the rank of lieutenant-general, though the military experience of the distinguished senator had been limited to service as aide-de-camp to General Jackson and colonel of volunteers in the War of 1812, and he had since been in civil life more than thirty years. Fortunately, the Senate refused its consent to the bill creating the new office for Benton's occupancy,[86] and Cerro Gordo, Contreras, Churubusco, and Chapultepec were won in spite of the action of Polk.

When the War of Secession broke out, the United States was in its habitual unprepared condition. At the close of the Mexican War the regular army had been reduced to eight regiments of infantry, four of artillery, two of dragoons, and one of mounted riflemen. In 1855 this force had been increased by two new regiments of infantry and two of cavalry, making a total of nineteen regiments, and giving the Army an aggregate strength

of about 14,000 officers and men. This was the total organized military force of the Nation in 1861.

During the quarter of a century before the Civil War the Navy had received fair support from Congress. In this period the Naval Academy was founded, and the construction of the frigates of the *Niagara* and *Merrimac* type gave to the navy some of the finest war-ships on the ocean. But, though excellent in quality, the Navy was deficient in size. In 1853 James Buchanan, then minister to England, declared that if either England or France should determine to prevent the interference of the United States in Cuban affairs, they had the naval power necessary to do so; and he urged that we should have at least a navy powerful enough to command our own coasts.[87] In March, 1861, the total number of vessels in the Navy, including the unfinished Stevens battery, was ninety; of which number twenty-one were unserviceable, and only forty-two were in commission.[88] Most of the vessels in commission were on foreign stations, and the only naval force available for the defence of the Atlantic coast of the United States consisted of one frigate and eight smaller vessels.[89]

Such was the degree of preparation with which the United States entered upon its mighty struggle for existence!

THE WAR OF SECESSION.

The history of the War of Secession is a record of pluck and mismanagement. Beginning the contest in military nakedness, the American people had to improvise the means of warfare as best they might. The blunders of 1812 were repeated. The regular army was increased by the addition of nine new regiments of infantry, one regiment of cavalry, and one of artillery; but, though nominally regular soldiers, the troops in these new organizations were really raw recruits. Commissions as company and field officers in these regiments were, in many instances, bestowed upon men who had not the slightest military experience or training. Nor did the evil end in regimental commissions. Aspiring incompetency vaulted still higher; and (in the vigorous language of Horace Greeley) separate armies were "under the command of militia officers who had never smelt burning powder, unless in a squirrel hunt."[90]

The regular army, which with an "expansive" organization could have been promptly enlarged into an efficient army corps,

containing a great proportion of old soldiers, and commanded, in all but the subaltern grades, by officers of experience, was a mere handful of men. Its great service to the Nation consisted in furnishing qualified officers for high commands, and for the rapid dissemination of military knowledge among the patriotic, but inexperienced, citizen soldiery. As an organization it was lost to view among the immense armies of volunteers upon which the reliance of the Nation was necessarily placed, and was of but little weight in the great struggle.

A multitude of blunders attended the organization of the volunteers. Their officers were, at first, elected by the men, and discipline was thus injured to an incalculable degree. When new regiments were raised, they were not provided with recruiting depots, and the losses of battle not being repaired with recruits, the veteran regiments dwindled away to mere skeletons. Instances were known of divisions composed of twelve regiments going into action with less than 3,000 men in ranks.[91] At each new call for volunteers fresh regiments were raised, composed of raw troops, and generally commanded by inexperienced men. The new colonels, by virtue of their rank, often commanded brigades in which were veteran regiments led by lieutenant-colonels who had learned the profession of arms in the hard school of war, and the inexperience of the new commanders sometimes led to deplorable results. Thus blunder was coupled with injustice, and often followed by disaster.

CIVIL INTERFERENCE WITH MILITARY PLANS.

As if to increase the obstacles with which the national armies were contending, the direction of campaigns was undertaken by the President and his cabinet, whose mischievous intermeddling with the plans of generals surpassed the achievements of the Austrian Aulic Council. The efforts of the Federal commanders were combined struggles with the valor of foes and the zealous stupidity of friends. Political pressure compelled the President, against his own judgment, to detach from McClellan's army a division of 10,000 men at the outset of a great campaign, and to withhold McDowell's powerful corps after the campaign had begun.[92] At a time when it was of the greatest importance that the military operations in Virginia should be under the control of one general, the same potent force compelled the creation of three new military departments in that State, and caused two of

them to be placed under the command of epauletted politicians,[84] who were promptly defeated at the first opportunity.

Whether McClellan would have captured Richmond had he been allowed to carry out his own plans, may be open to question; but it is certain that the action of the President and his advisers was quite as effective as the skill of Lee or the genius of Jackson in causing the unfortunate termination of the campaign on the Peninsula.

An attempt of Burnside to turn the Confederate position at Fredericksburg was stopped by orders from the President, after the cavalry column, which was to cut Lee's railway communications, was already under way.[85] A movement by Hooker against Fredericksburg, when Lee's army was extended from that place to Winchester, which would probably have resulted in the capture of Hill's corps, and certainly would have prevented the invasion of Pennsylvania, was forbidden by Lincoln, in a message as whimsical as it was unfortunate.[86] The intolerable interference with all freedom of action on the part of Hooker, finally caused that general to throw up the command of the Army of the Potomac in disgust. After the movement on Mine Run, an advance upon Fredericksburg, which Meade contemplated, was forbidden by the orders from Washington with which he was hampered.[87] It is needless to mention all the instances of this unhappy interference of the administration; to do so would be to write a history of the war. By communicating directly with subordinate commanders, giving them orders without the knowledge of their military superior, and offering a ready ear to their suggestions and criticisms, a spirit of insubordination, pernicious in the extreme, was fostered by the administration, and the door was thrown open to the machinations of self-seeking subaltern generals, who destroyed their own efficiency and embarrassed the administration by their struggles for their own aggrandizement. The intermeddling spirit of the authorities at Washington was not displayed in Virginia alone: Grant, Buell, and Rosecrans were not far enough away to escape its vexations,[87] though their annoyance was slight in comparison with that of the commanders of the Army of the Potomac.

Yet the interference of the administration with the generals in the field was often, if not generally, due to the pressure brought to bear by congressmen, "war governors," and other civil officials, who were in turn pushed on by the impatience and military

ignorance of a patriotic people. It was only when three years of bitter experience had educated the people to an appreciation of the requirements of war, that a general was placed in untrammeled command of the armies, and the rebellion began to sink under the blows of power guided by military science.

The naval policy of the United States during the War of Secession was, in the main, well-shaped and vigorously carried out. Yet the energy which speedily transformed a paper blockade into a reality, by the conversion of all manner of merchant-craft into men-of-war, was not accompanied by the prescience that could anticipate the approaching revolution in naval warfare. The behavior of the French iron-clad batteries at Kinburn, and the construction of the *Warrior* and *La Gloire*, foreshadowed the advent of armored vessels into modern navies; yet it was not until the *Merrimac* was in process of construction at Norfolk, and four other powerful iron-clads were building at New Orleans and Memphis, that the construction of three armored vessels for the Federal navy was ordered.[98] Fortunately, the zeal of Ericsson counter-balanced this indifference; and, by sheer good-fortune, the *Merrimac* was defeated, the Federal fleet rescued, and a great national disaster averted, by the opportune arrival in Hampton Roads of a vessel which was still an experiment, and had scarcely left the hands of the workmen.[99]

CONFEDERATE MILITARY POLICY.

The military policy of the South was quite in contrast with that of the North. Conscription was resorted to at an early date; and the regiments originally organized were kept at their full strength by constant accession of recruits, until the supply was practically exhausted. Great care was exercised in selecting officers for the command of armies. Political influence made itself felt, it is true, in the South as well as in the North; but such improvised generals as Robert Toombs and Howell Cobb were discreetly kept in the background, where their inexperience could not breed disaster. The efforts of the South to create a navy were strenuous and unremitting; and its failure to accomplish any important results on the water was due solely to a lack of ship-building advantages.

In one respect the lessons of past wars were heeded by both the North and the South. Militia was almost unknown in the contending armies. The record of the Southern militia reads like

a brief and belated chapter from the history of the War of 1812. The Georgia militiamen were a perpetual thorn in the side of the government at Richmond; and it is safe to say that they caused more annoyance to Jefferson Davis than to General Sherman. Their devotion to their cause was not sufficient to lure them beyond the limits of their State; and only in one instance did they perform any duty beyond the boundaries of Georgia. On that occasion, a train, containing sleeping militiamen, was switched off on another railroad, and the home guards awoke in South Carolina, where they performed some duty while in a condition of geographical uncertainty.[100] In some parts of Missouri, Kentucky, Arkansas, and Tennessee, militia occasionally appeared as bushwhackers and guerrillas.

COST OF THE WAR OF 1861–5.

After four years of bitter struggle, which left the South completely exhausted, and strained the North to the last point of endurance, the war ended. The severe training of war had evolved from the raw levies of 1861 the battle-tried veterans, who, in 1865, were peerless among the armies of the earth; the feeble navy had grown into the most powerful force upon the seas; and the contest had terminated in national triumph. Satisfied with the result of the conflict, and proud of the visible power of the United States, the people generally ignored the needless cost of the war, or merely found another cause of self-gratulation in the national capacity to endure the enormous burden. The Union was preserved at the expense of $8,000,000,000,[101] and the more lamentable cost of more than half a million lives.[102] The war being unexpected, almost until the very moment of its beginning, no special preparation could be made to meet it; but it is certain that the appalling expenditure of blood and treasure which it drew from the Nation could have been avoided if judicious measures of military and naval preparation had not been continually sacrificed to a spirit of false economy.

If 30,000 regular troops had been pitted against the raw levies of the South on the batttle-field of Bull Run, the Confederate Army would have met with a crushing defeat; Richmond would have fallen within a month; and the *morale* of the undisciplined Southern troops, instead of being raised to a high pitch by early success, would have been so shaken that the war would have ended in less time than it really took to get military opera-

tions fairly under way. A regular force of the stated size could have overwhelmed such ill-disciplined masses as it would have encountered, as easily as Ross crushed the patriotic rabble opposed to him at Bladensburg; and if the successes of the regulars had then been promptly followed up by a volunteer army of occupation, the same year that witnessed the opening of the war would, probably, have beheld its close.

Nine years ago General McClellan stated that the amount that had then been paid out by the United States in pensions on account of the Civil War, would have been sufficient to maintain 30,000 additional soldiers from the close of the Mexican War to the beginning of the Rebellion.[103] This statement may now be made still stronger. The amount paid out in pensions since 1861, on account of the War of Secession, exceeds $700,000,000[104]; a sum which, if added to the appropriations that were actually made, would have been more than sufficient to maintain an army of 45,000 men from the beginning of the Seminole War to the breaking out of the Rebellion.[105] With a regular army of that size, it would have been an easy matter to place 30,000 choice troops in the field at the first sound of war; and there can be no doubt that the supposed force would have been thoroughly loyal. The defection of Southern army and navy officers has been greatly exaggerated, and but little mention has been made of the devotion of those who sacrificed home and friends on the altar of their country. George H. Thomas, Farragut, Gibbon, Buford, French, and Hunter were not the only Southern officers who battled for the Union cause; and the unanimity of the enlisted men of the regular army in their loyalty to the national flag was one of the most remarkable features of the war.

Even supposing the volunteer armies of occupation to have numbered 300,000 men (doubtless an extravagant estimate), and supposing the cost of a volunteer regiment to have been twice that of a corresponding regular organization; estimating then the other expenses of the war at the enormous figure of an equality with those required for the maintenance of the armies; adding to this the cost of supporting a regular army of 45,000 men for twenty-six years before the war; and then allowing the most extravagant estimate for naval expenses, it is impossible to make the sum required for a year of successful war equal to $2,000,000,000. Taking the cost of former American wars as a standard; comparing the number of men and the duration of the war with

the number of men and the time that would have been required for the suppression of the Rebellion, if the United States had been in the condition of preparation supposed, we cannot possibly make the cost equal to $2,000,000,000.[106] Thus, while it is of course impossible to compute accurately what the cost of suppressing the Rebellion would have been, if, instead of being compelled to give the enemy time to perfect his raw soldiers while we were preparing our own, we had been able to strike him at once with a strong military and naval force, it is impossible to avoid the conclusion that the want of warlike preparation cost the United States at least $6,000,000,000. Estimating the present population of the United States at sixty millions, this amount would be sufficient to give a hundred dollars to every man, woman, and child in the Republic. Such is the cost of *economy!*

That we are making greater efforts to reward the victims of the parsimonious policy of the last generation than to prevent future calamities, is shown by the fact that the annual expense of the national pension-roll exceeds the combined yearly appropriations for the support of the Army and Navy.

Difficult and costly as the preservation of the Union was, the difficulties and expense would have been greater, if the enemy had not been in a still poorer degree of preparation than ourselves. The troops of the North were, at first, raw levies; so were the soldiers of the South. The Union had only a feeble navy; the Confederacy had none at all. The North was deficient in heavy ordnance, and even in small-arms; the deficiency of its foe was even greater, nor had he such means of creating the munitions of war as were at hand in the North. The sea-board of the Union was not menaced; while the Federal Navy soon blockaded the Southern coast, and deprived the Confederates of the needful manufactured articles for which an agricultural people must ever be dependent upon foreign supply.

POST BELLUM REACTION.

The bitter regret expressed during the war because of the neglect of military preparation in past years, and the resolve to make adequate provision in future for national defence, were quickly forgotten in the rejoicing over victory and peace. The strength of the regular army authorized in 1866, upon the general disbanding of the volunteer forces, was 54,641 men; but the

disappearance of the war cloud in Mexico and the restoration of order in the Southern States were followed by a reduction of this force to an effective strength of less than 25,000. The navy met with a sweeping reduction, the number of war-vessels being reduced from 672 to 130. The only improvement in military organization resulting from the war is found in the expansive structure—as yet crude and imperfect—of the regiments of the regular army, by which the present force could be promptly expanded into an army of about 45,000 men, and the provisions made for the general dissemination of military knowledge by a system of military instruction at colleges. Both of these measures of sound military policy are, however, in a chrysalis state, and do not meet with proper appreciation on the part of those who shape our national laws.

In serene over-confidence, caused by the successful termination of a great war, undertaken with but little preparation against a foe more empty-handed than themselves, the American people seem to be waiting for the rude shock of national disaster to dispel their illusions of security. Though every page of the military and naval history of the United States is a sermon on the text, "In time of Peace prepare for War," our sea-coast defences consist of antiquated fortifications, armed with obsolete guns; our torpedo service is enervated by the neglect of Congress to provide it with a sufficient number of engineer soldiers; and our Navy is composed of impotent wooden vessels and "old quasi iron-clads," which, Admiral Porter declares, the enemy would sink as worthless after he had obtained possession of them.

Erroneous and dangerous conclusions have been drawn from the ease with which a navy was improvised to meet the national needs during the Rebellion. Then the most powerful iron-clad in the world was built in less than four months; now a first-class war-vessel requires from three to ten years for its construction, and the manufacture of the heavy guns for its armament now takes three times the length of time then required for the building of the vessel. Yet, notwithstanding these facts, and regardless of the helpless exposure of property of enormous value to the destructive range of a hostile fleet, a "nation of debaters" is just beginning to take steps towards the creation of a navy, after having wasted, in eighteen years, in patching old wooden vessels, more than enough money to have built, *and kept*

in repair, nineteen iron-clads like the British *Inflexible*, eleven like the Italian *Lepanto*, or thirty-nine steel cruisers like the *Chicago*.[107] Too penurious to build new vessels, we have wasted in repairs the cost of a formidable fleet. This is another illustration of the expensiveness of our national economy.

OUR PRESENT WEAKNESS.

There is, probably, no part of the organized fighting force of the United States that is not suffering from the short-sighted policy that governs the military and naval affairs of the Nation. Forgetful of the immeasurable value of the regular army at the outbreak of every war, the people seem to be returning to the pernicious policy of regarding the Army merely as a national police force, to be maintained for the purpose of protecting the settlers of the West, or crushing such riots in the East as may get beyond the control of the municipal police or State militia. Ignoring the axiom that, as a "school for officers and a model for the militia" the regular army should be perfect in its organization, arms, and equipments, Congress has so neglected the Line of the Army, that to-day the light batteries are armed with guns of a type long since discarded by all European nations, and the infantry is cursed with a worn-out organization, nowhere else to be found save among the half-civilized nations of Asia. The system of infantry tactics now in use is not adapted to the requirements of the modern battle-field, nor can a proper system be grafted upon the present obsolete organization of the infantry regiments. If we were suddenly to become involved in war, we should find ourselves not only without sea-coast fortifications, without a navy, without heavy ordnance, and without suitable field artillery, but we should also be compelled to adopt a new regimental organization, and learn a new system of tactics, in the presence of the enemy.

There are indications of an awakening of the people to the necessity of providing for national defence. Public opinion, slow to move, has at last been roused to an appreciation of our dangerous lack of military and naval preparation; and Congress, quick to feel the pulse of popular sentiment, begins to show signs of interest in sea-coast fortifications and the Navy. It is to be hoped that the growing force of popular interest in military and naval matters may result in the creation of a navy worthy of the Nation, in the construction and armament of fortifications

for our maritime cities, and in giving to the Army such an organization as to secure its efficiency in time of war. Yet, judging from our past history and the nature of our Government, the present interest in providing for national defence is a mere spasm of patriotic alarm; and it is to be feared that when the popular demand shall have been satisfied, and the nation shall have been placed in a good condition of defence, apathy will follow interest, aad our military and naval preparations will again drift far behind the necessities of the country. In a monarchy, warlike preparation is "an incessant childbirth," the new continually replacing that which becomes obsolete; in a republic, unless it be continually menaced by powerful neighbors, the military policy is generally characterized by an alternation of activity with sloth, of zeal with apathy; and the commonwealth is indeed fortunate if war does not come upon it in one of its unprepared periods.

POPULAR MILITARY EDUCATION.

The foundation of wise military legislation in the United States is to be found only in the military education of the voters. However it may be inspired—whether by cool reason or the bitter lessons of adversity—the interest of the people in military matters must be aroused, and must become a perpetual spur to the action of the national legislators, before a sound military policy can be adopted by the nation. To say that in the United States the people govern, is to express the literal truth. In making a speech, a Member of Congress talks over the shoulder of the speaker, to his own constituents; and his vote is often decided less by his own wisdom than by the opinion of those whom he represents. Public sentiment rules the land; and public sentiment is not always guided by wise counsels, nor free from the prejudices of ignorance. James Fenimore Cooper truly says: "Every form of government has evils peculiar to itself. In a democracy there exists a standing necessity for reducing every thing to the average comprehension, the high intelligence of a nation usually conceding as much to its ignorance as it imparts. One of the worse consequences of this compromise of knowledge, in a practical sense, is to be found in the want of establishments that require foresight and liberality to be well managed; for the history of every democracy has shown that it has been deficient in the wisdom which is dependent on those expendi-

tures which foster true economy, by anticipating evils and avoiding the waste of precipitation, want of system, and a want of knowledge."[188]

The intolerance of the people of all financial burdens that do not promise a speedy return of general profit; their ill-considered but deep-rooted jealousy of a standing army of any but insignificant proportions, as a menace to popular liberty; and their general indifference to all measures of national preparation for future wars, are, doubtless, fruits germinated in the ignorance rather than the high intelligence of the Nation; but they are formidable obstacles to the introduction of any definite and well-considered military and naval policy.

Though the popular mistrust of a standing army seems to be derived mainly from the records of ancient nations or the annals of the Latin races, and to ignore the loyalty and love of liberty that have always characterized the Anglo-Saxon soldier in either hemisphere, the jealousy—be it wise or foolish—is deep-seated, and must be regarded as an important element in shaping the military policy of the United States.

There is another obstacle in the way of maintaining a regular army of any but limited proportions, which is none the less insuperable because it is founded in selfish ambition. The history of the United States shows that the war party has always been the party of popular favor; and the history of all democracies proves that military success is the shortest road to political preferment. From the days of the Athenian Republic to our own time, politicians have sought to supplement the triumphs of the forum by the glories of the field; and aspiring legislators will steadily oppose the support of a regular army of such size as to admit of all the fighting being done by trained soldiers, and all the glory reaped by professional military leaders.

The impatience of the people with generals whose plans they do not comprehend, and the interference of civil rulers with the direction of armies, seem to be inherent evils in republican management of war. Our own republic is not alone in these respects; the history of the commonwealths of antiquity, of the Dutch Republic, of the French Democracy of the last century, and of Republican France of 1870–71, all tell the same story of generals struggling with an enemy at the front and political intermeddling at home. That interference with the plans of a general is disastrous even in a monarchy, was shown in the manner in

which Bazaine and McMahon were handicapped by the presence of Napoleon III., and in the unhappy effect of the presence of Alexander II. with the Russian Army before Plevna. Yet in these instances, the rulers were themselves men of military education. If in an absolute monarchy the interference of a ruler, himself trained to war, can vex the mind and thwart the plans of a general, infinitely worse will be the case in a republic, where the will or the whim of the people, voiced through the press, can precipitate a movement, or change the plan of a campaign, in opposition to the judgment of the commander, and, perhaps, even that of the civil ruler himself.

OUR MILITARY FUTURE.

Founding our prevision upon the lessons of the past, it is clear that our military future will not be shaped by theories based upon military principles alone. The military policy of the United States will be strongly affected by the popular predilection for economical expenditures in time of peace; by a jealousy of large standing armies; by a reliance upon volunteers in time of war; and by a more or less active influence of popular opinion in the direction of armies in the field.

A military and naval policy suited to the nature of our country and the genius of our institutions would, doubtless, be characterized by the maintenance of the regular army, not in great strength, but in the highest possible degree of excellence; by the organization of the Army on such a basis as to admit of a great expansion in time of war; by the watchful care and continual improvement of the Navy, a special appropriation being made annually for the construction of new vessels fulfilling, in every respect, the naval requirements of the age; by the exercise of vigilant care in maintaining the sea-coast fortifications in such a condition that they should be able to repulse any naval force sent against them; and, above all, by the generous support of all measures for the promotion of military knowledge among the people.

The last feature of the policy outlined above is not only the most important, but it is the one on which all the others depend, and without which they cannot be properly carried out. A better knowledge of the requirements of war would end the sacrifice of future treasure to present parsimony; it would inspire patience with our military leaders at the beginning of a war; it

would remove the idea that generals can be improvised by placing insignia of rank on the shoulders of men who have never given a moment's study to the Science of War; it would disabuse the popular mind of the illusion that an army can be created of the rawest material merely by a call to arms; and it would impress upon the people an appreciation of the fact that "if education is rapid on the field of battle, its cost is far too dear."

NOTES.

1 Bancroft's "History of the United States," vol. v., p. 51.

2 *Ibid.*, p. 83.

3 *Ibid.*, pp. 91–2.

4 *Ibid.*, pp. 100–1.

5 *Ibid.*, p. 204.

6 *Ibid.*, p. 449.

7 *Ibid.*, p. 172.

8 "Human patience has its limits," wrote Lafayette to his wife. . . . "No European army would suffer the tenth part of what the American troops suffer."—Bancroft's "History of the United States," vol. v., p. 452.

9 McMaster's "History of the People of the United States," vol. i., p. 186.

10 Hildreth's "History of the United States," vol. iv., p. 224.

11 McMaster's "History of the People of the United States," vol. i., pp. 167–8, 186, 503.

12 *Ibid.*, p. 599, *et seq.*

13 Hildreth's "History of the United States," vol. iv., p. 272.

14 McMaster's "History of the People of the United States," vol. ii., p. 44, *et seq.*

15 Hildreth's "History of the United States," vol. iv., p. 304.

16 *Ibid.*, p. 520.

17 *Ibid.*, p. 628.

18 *Ibid.*, vol. v., pp. 223, 346.

19 *Ibid.*, p. 284.

20 Cooper's "History of the Navy of the United States," vol. i., p. 259.

21 Hildreth's "History of the United States," vol. iv., p. 480.

22 Cooper's "History of the Navy of the United States," vol. i., pp. 268, 269.

23 Hildreth's "History of the United States," vol. v., pp. 195, 206.

24 *Ibid.*, p. 222.

25 McMaster's "History of the People of the United States," vol. ii., pp. 385–8.

26 Hildreth's "History of the United States," vol. v., p. 283.

27 Cooper's "History of the Navy of the United States," vol. i., p. 303.

28 Hildreth's "History of the United States," vol. v., p. 438, *et seq.*; and Bryant's "History of the United States," vol. iv., p. 175.

29 Hildreth's "History of the United States," vol. v., p. 473.

30 *Ibid.*, pp. 507, 529.

31 Messages of President Jefferson, Dec. 8, 1801.

32 *Ibid.*, Nov. 8, 1804.

33 *Ibid.*, Dec. 3, 1805.

34 Hildreth's "History of the United States," vol. v., p. 539.

35 *Ibid.*, p. 439.

36 *Ibid.*, vol. vi., p. 30.

37 *Ibid.*, p. 30; and "Hamersly's Naval Encyclopedia," p. 534.

38 Hildreth's "History of the United States," vol. vi., pp. 58–9.

39 Ingersoll's "History of the War Department," p. 31.

40 See Appleton's "American Cyclopedia," vol. xvi., p. 144.

41 Hildreth's "History of the United States," vol. iv., pp. 451, 693; vol. v., p. 439; and vol. vi., p. 296.

42 Cooper's "History of the Navy of the United States," vol. ii., p. 116.

43 Hildreth's "History of the United States," vol. vi., p. 308. Alison gives the strength of the American forces as four frigates, eight sloops, and six thousand men.—"History of Europe," chap. lxxvi. Cooper mentions twenty vessels, of which number two were unseaworthy, and one was a small vessel of sixteen guns on Lake Ontario.—"History of Navy of the United States," vol. ii., p. 143. The *nominal* strength of the Army appears to have been 13,000 men.

44 Ingersoll's "History of the War Department," pp. 39, 40.

45 *Ibid.*, p. 46.

46 Shaler's "History of Kentucky," p. 164.

47 Hildreth's "History of the United States," vol. vi., pp. 505, 507, 509.

48 *Ibid.*, p. 559.

49 *Ibid.*, p. 560.

50 *Ibid.*, p. 275.

51 Hildreth's "History of the United States," vol. vi., p. 309. Most of these officers had seen service in subordinate grades in the Revolution, but they had been in civil life about thirty years.

52 See extract from the records of the Third Auditor's office, in Upton's "Armies of Asia and Europe," p. 321.

53 Hildreth's "History of the United States," vol. vi., p. 339.

54 *Ibid.*, p. 505, *et seq.* The strength of the British forces is given on the authority of Chaplain-General Geo. R. Gleig, of the British army, who participated in the battle. See *Magazine of American History*, May, 1886.

55 Hildreth's "History of the United States," vol. vi., pp. 501, 509.

56 Shaler's "History of Kentucky," p. 165. Hildreth (vol. vi., p. 437) gives the strength of the British at 800, and does not mention the strength of the Indians.

57 Hildreth's "History of the United States," vol. vi., p. 558, *et seq.*

58 *Ibid.*, p. 508.

59 *Ibid.*, p. 459.

60 For details of organization of volunteers (of whom 50,000 were authorized) see Hildreth, vol. vi., p. 275. For number actually in service, see extract from records of the Third Auditor's office, in Upton's "Armies of Asia and Europe," p. 321.

61 Cooper's "History of the Navy of the United States," vol. ii., p. 201.

62 *Ibid.*, p. 282.

63 Hildreth's "History of the United States," vol. vi., p. 504.

64 *Ibid.*, vol. iv., p. 480; vol. v., p. 222. One of these frigates, the *Congress*, cost only $197,246. See Hamersly's "Naval Encyclopedia, p. 604.

65 The cost of a ship-of-the-line, in 1812, was $333,000. See Hamersly's "Naval Encyclopedia," p. 297.

66 Bryant's "History of the United States," vol. iv., p. 205.

67 Appleton's "American Cyclopedia," vol. xvi., p. 144.

68 Bryant's "History of the United States," vol. iv., p. 240.

69 McMaster's "History of the People of the United States," vol. ii., p. 324.

70 Hildreth's "History of the United States," vol. vi., p. 571.

71 *Ibid.*, p. 592.

72 *Ibid.*, p. 705.

73 "Memoirs of John Quincy Adams," by Charles Francis Adams, vol. v., p. 321.

74 Hildreth's "History of the United States," vol. vi., p. 705.

75 Message of President Jackson, Dec. 8, 1829.

76 Benton's "Thirty Years' View," vol. i., pp. 554–6.

77 *Ibid.*, pp. 592, 593.

78 *Ibid.*, p. 590, *et seq.*

79 *Ibid.*, vol. ii., p. 272.

80 Sprague's "History of the Florida War," p. 102.

81 *Ibid.* Benton ("Thirty Years' View," vol. ii., p. 70) estimates the cost of the Seminole War at $30,000,000.

82 Report of Paymaster-General Towson, May 8, 1838.

83 Rodenbough's "From Everglade to Cañon with the Second Dragoons," p. 82.

84 Upton's "Armies of Asia and Europe," p. 322.

85 *Ibid.*, p. 322.

86 Benton's "Thirty Years' View," vol. ii., p. 678.

87 Letter to Henry A. Wise, of Virginia, Sept. 5, 1853.—See speech of Senator Edmunds, April 10, 1884.

88 Soley's "The Blockade and the Cruisers," Appendix "A."

89 *Ibid.*

90 "The American Conflict," vol. i., p. 548.

91 Hazen's "School and Army in France and Germany," p. 182.

92 Swinton's "Army of the Potomac," p. 93.

93 *Ibid.*, p. 122.

94 *Ibid.*, p. 257.

95 *Ibid.*, pp. 315, 316.

96 *Ibid.*, p. 298 (note).

97 Cist's "Army of the Cumberland," p. 148.

98 Hamersly's "Naval Encyclopedia," p. 576; and Soley's "The Blockade and the Cruisers," p. 55.

99 Soley's "The Blockade and the Cruisers," p. 58.

100 Taylor's "Destruction and Reconstruction."

101 "History of the United States," by Alexander H. Stephens.

102 See extract from report of Provost-Marshal-General for 1865, in Upton's "Armies of Asia and Europe," p. 322.

103 "The Regular Army of the United States," by Gen. McClellan, in *Harper's Magazine*, Oct., 1877.

104 "The United States Pension Office," by E. V. Smalley, *Century*, July, 1884.

105 As a basis of computation, the writer accepts the estimate of the War Department, as quoted by Senator Pearce, of Maryland, Jan. 30, 1855 (see *Congressional Globe*); namely, $644,292 for a regiment of cavalry, and $450,813 for a regiment of infantry, annually; the companies consisting of sixty-four privates.

106 In 1865, when the United States had an enormous navy and army of more than a million men, the gross expenditures—war, navy, Indians, pensions, miscellaneous, premiums, interest, and public debt—were $1,906,433,331. See Appleton's "American Cyclopedia," vol. xvi., p. 146.

107 The cost of the *Inflexible* was about $2,500,000, and that of the *Lepanto* is estimated at $5,000,000. The cost of keeping a first-class armored vessel in repair varies from $20,000 to $50,000 a year. The latter figure has been assumed in this computation. The estimated cost of the *Chicago* is $1,295,000, and the annual cost of her repairs is assumed at $20,000. [These figures are taken from the report of Gen. Gillmore, 1881—Appleton's "Annual Cyclopedia," 1882, and the *Army and Navy Journal.*] The amount of money expended for repairs of war-vessels from 1866 to 1884 was more than $65,000,000.—See *Congressional Record*, March 6 and April 10, 1884.

108 Cooper's "History of the Navy of the United States," vol. i., p. 329.

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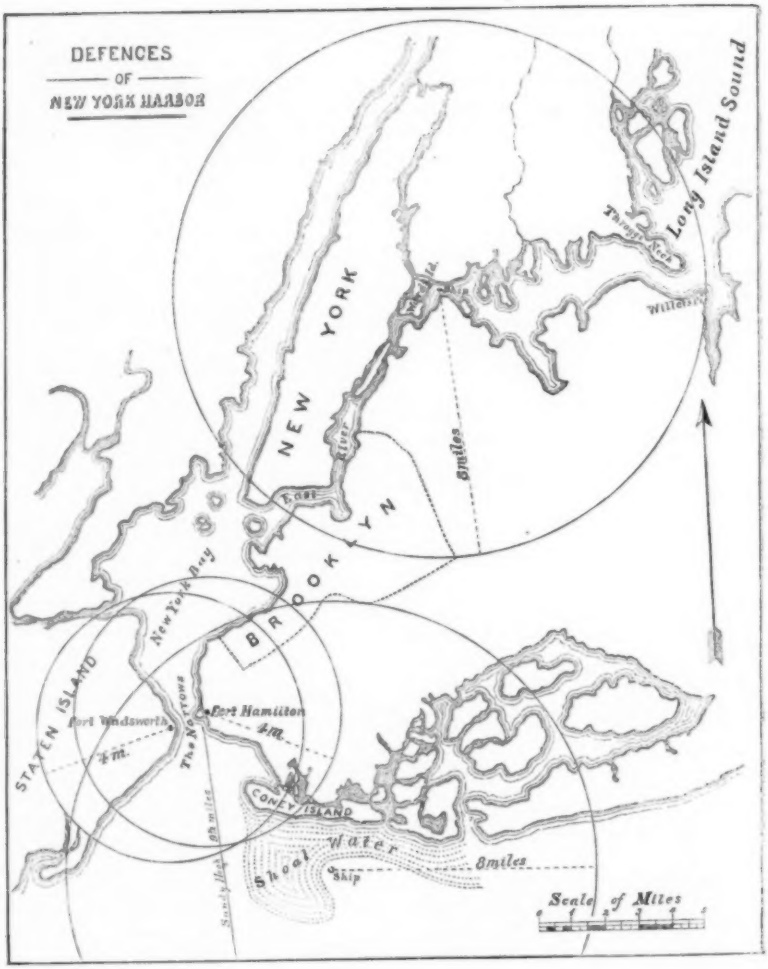
DEFENCES
OF
NEW YORK HARBOR
Long Island Sound
NEW YORK
BROOKLYN
East River
8 miles
New York Bay
STATEN ISLAND
Fort Lafayette
Fort Hamilton
Fort Wadsworth
The Narrows
4 m.
4 m.
CONEY ISLAND
Shoal Water
8 miles
Ship
Sandy Hook
Scale of Miles

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OUR SEA-COAST DEFENCES.

By LIEUT. EUGENE GRIFFIN, U.S.A.,
CORPS OF ENGINEERS.

PART I. OUR SEA-COAST DEFENCES, PAST AND PRESENT.

ENGINEERS have divided our early fortifications into three systems: (1) those built before and during the Revolutionary War; (2) those built subsequent to the Revolution but previous to the War of 1812; (3) those built since 1816. The last alone are of present importance, as they still constitute the major part of our maritime defences.

The utter inadequacy of temporary sea-coast fortifications was painfully evident during the second war with Great Britain, and demanded immediate attention upon the declaration of peace. In 1816, a comprehensive system was devised by a board of engineer officers, approved by the Chief of Engineers and the Secretary of War, and adopted by Congress; and yearly appropriations were thereafter made for the construction of the works.

In planning this system the board considered that "fortifications must:

"1st. Close all important harbors against an enemy and secure them to our military and commercial marine.

"2d. Deprive an enemy of all strong positions where, protected by naval superiority, he might fix permanent quarters in our territory, maintain himself during the war, and keep the whole frontier in perpetual alarm.

"3d. Cover the great cities from attack.

"4th. Prevent, as far as practicable, the great avenues of interior navigation from being blockaded at their entrance into the ocean.

"5th. Cover the coast-wise and interior navigation by closing the harbors and the several inlets from the sea which intersect the

lines of communication, and thereby further aid the navy in protecting the navigation of the country.

"6th. Protect the great naval establishments." *

To accomplish these results fortifications were so placed as to command the harbor entrances, channels, and rivers requiring defence, and interior works constructed to command all positions which might be occupied by the enemy should he succeed in forcing the main line. These works consisted mainly of masonry casemates with two or more tiers of fire, surmounted by earthen barbette batteries. Stone walls were less vulnerable than wooden walls, and land fire more accurate and steady than that of ships; hence, while engineers had long recognized the principle that all masonry should be shielded from land fire by earthen masks, the same secure cover was not necessary for sea-fronts. Guns at least equal in numbers and calibres to those of any possible attacking squadron were mounted in these works; the several tiers providing sufficient emplacements and permitting a great concentration of guns on a comparatively contracted site.

The works were given but slight command, the better to utilize the advantages of ricochet fire; and land-fronts of greater or less strength were added, to enable the garrison to withstand a siege of from ten to fifty days.

During the long periods of peace which followed the War of 1812, many conditions were altered both in the attack and defence, and corresponding changes were required in the system. The introduction of the steam-engine rendered ships independent of wind and weather, and this advantage was so greatly increased by the invention of the screw propeller, which placed the motive power out of sight and reach of the guns, that channel obstructions, to prevent the ships from running by the batteries, became an absolute necessity and an important feature of the defence.

The invention of the magnetic telegraph and the construction of innumerable lines of railroads so facilitated the concentrations and movements of troops that the costly land-fronts became unnecessary, except in specially isolated works; it being deemed sufficient to provide such defences as would protect the garrison from surprise or enable them to repel a sudden assault.

The latest and strongest of our granite forts were built with eight-foot walls, reduced to five feet in the vicinity of the gun-ports. Totten's iron casemate embrasure protected the can-

* Revised Report of the Board of Engineers, March 24, 1826.

noneers from direct fire when the shutters were closed, and from glancing shots when open, a degree of security not possessed by the works of any other nation. This invention of our chief engineer is of historic interest as the first instance of the use of iron plating on land batteries.

These works were model sea-coast fortifications in their day, and none better existed in the world; but it should be remembered that they were only intended to withstand the fire of the old 10- and 13-inch smooth-bores, guns inferior in power to even the 8-inch rifle of the present day, to say nothing of the 16- and 17-inch guns.

The appearance of the French iron-clad floating batteries during the Crimean War marked the beginning of a new era in naval warfare; and their engagement with the Russian forts at Kinburn * gave rise to serious doubts as to the ability of masonry casemates to withstand these new engines of attack. Heretofore ships had been unable to remain under fire sufficiently long for their guns to produce serious effect upon the batteries, but the use of iron plating reversed the conditions as to security of cover and inclined the balance in favor of the attack.

The developments of our civil war,—the broadside and turreted iron-clads and the long-range heavy ordnance, both smooth-bore and rifled, demonstrated this superiority beyond question, and marked the complete downfall of our third system of sea-coast defences.

The period since the close of that war has been prolific in great advances in the means and methods of attack. The iron plating of ships-of-war has been increased from four inches to twenty-five inches on the English ship *Inflexible*, and when a practicable limit as to the thickness of iron plates seemed reached, compound armor and all-steel plates were introduced. Recent British ships carry eighteen inches of compound armor, and the *Admiral Baudin* and *Formidable* of the French navy are protected by solid steel plates twenty-one and seven eighths inches in thickness.

Heavy ordnance has increased in weight and power to a like extent. Whereas in 1862 our 200-pounder Parrott rifle was one of the most effective weapons extant, we have, in 1872, the English 17¾-inch, 100-ton gun, firing a projectile weighing one ton with a

* Oct. 17, 1855. The three floating batteries (Devastation, Lave, and Tonnante) were protected by iron plates each three feet long, twenty inches wide, and four and one half inches thick.

powder charge of 550 pounds, and in 1884, the 16¼-inch, 110-ton Armstrong, which fires an 1,800-pound projectile, with the enormous charge of 900 pounds of powder, giving a muzzle energy of 61,200 foot-tons, and a penetration of over thirty inches of wrought iron at 1,000 yards. The recent Krupp 15¾-inch steel gun weighs 119 tons, and penetrates 29.2 inches of iron at 1,000 yards; and the projected French gun is to weigh 124 tons, with a calibre of 18.11 inches, and to fire a projectile weighing 2,645 pounds, with a powder charge of 575 pounds.*

Important improvements in the manufacture of powder have greatly increased the power of heavy ordnance. The grains have been made larger and denser, so as to burn more slowly and to diminish the initial and dangerous strain on the gun. Grains of uniform size insure uniform results, and perforated prismatic grains give increasing surfaces of combustion, and hence increasing volumes of gases during the movement of the projectile in the bore. Where we used a 35-lb. charge for the 15-inch gun during the war, we now use 130 lbs. "Cocoa" powder, so called from its color, is now superseding all other varieties for heavy ordnance. The grains are dense hexagonal prisms about one inch long, and one and a third inches across the hexagon, with a cylindrical perforation about one third of an inch in diameter. Its method of manufacture is still a secret, but it is said to light with great regularity, burn very slowly at first, and then with tremendous rapidity. It is claimed that this powder gives less smoke than any other variety, an important point when we consider the heavy charges now used with sea-coast ordnance. It is rather a striking fact that a six-gun field battery of three-inch rifles, firing two rounds per minute from each gun, would, in an hour and a quarter, only consume as much powder as is fired in one round from the 110-ton gun. The impenetrable veil of smoke surrounding a sea-coast battery after even a single discharge from its heavy guns will, at times, be a great obstacle to accurate fire, and will make well-scattered works a necessity.

To insure the complete combustion of such large charges of slow-burning powder, guns have been gradually increased in length up to the present limit of 35 calibres.

Important improvements have likewise been made in the manufacture of projectiles. One measure of the efficiency of a gun is its power of penetrating a wrought-iron plate at a dis-

* See Table I.—Modern Heavy Ordnance.

TABLE I.

MODERN HEAVY ORDNANCE.

Country where made.	Nature of gun.	Date.	Weight of gun in tons.	Calibre of gun in inches.	Length of gun in feet.	Charge. Weight of Powder.	Charge. Weight of Projectile.	Muzzle velocity.	Muzzle energy.	Energy per ton of gun.	Penetration; in inches of wrought iron at 1,000 yds.	Remarks.
France .	46 c. m., B. L.	*	124	18.11	33.6	575	2,645	1,640	49,315	398	28.1	* Not yet constructed.
	42 " "	1875	75	16.50	30.2	?	1,716	1,738	35,932	480	24.2	† Capt. Noble says that
	37 " "	1884	71	14.56	36.4	546	1,180	1,955	31,272	440	24.5	51,900 ft.-tons muzzle
	34 " "	1881	52	13.38	34.1	362	926	1,968	24,868	478	22.9	energy has been obtained
England .	Elswick, B. L.	1884	110	16.25	43.5	900	1,800	2,020	50,924 †	513	30.5	with the 100-ton gun, and
	" "	1882	100	17.00	39.5	772	2,005	1,832	46,600 †	460	28.5	that 61,200 ft.-tons is the
	" M. L.	1872	100	17.72	32.6	550	2,022	1,715	41,226	412	25.9	*computed* energy of the
	" wire gun, B. L.	1884	18	9.20	20.0	200	380	2,200	12,759	709	20.0	110-ton gun.
	Woolwich, M. L.	1875	81	16.00	26.8	445	1,760	1,657	33,360	412	24.7	Armstrong is con-
	" B. L.	1884	63	13.50	36.0	625	1,250	2,050	36,415	569	28.6	structing 17" guns for
	" "	1883	46	12.00	27.4	450	849	2,100	26,412	574	24.0	the Italian iron-clad "Le-
	" "	1882	43	12.00	25.0	260	714	1,936	18,882	439	20.3	panto," similar to the 100-
	" wire gun, B. L.	1884	19	9.20	24.2	330	380	2,520	16,730	880	23.2	ton gun in all respects
Germany .	Krupp, 40 c. m., B. L.	1884	119	15.75	45.1	615	1,632	2,017	46,061	387	29.2	except in length. They
	" " " "	1881	71	15.75	32.8	485	1,715	1,703	34,502	486	23.8	weigh 102 tons.

tance of 1,000 yards. The shot is the medium through which the power stored in the powder is made effective on the plate; and the energy of the projectile depends directly upon its weight and the *square* of its velocity. Every foot-pound of this energy which is expended in distorting or disintegrating the shot itself is so much wasted work, and in these days of armor plates of tremendous resistance the necessity of having a perfect projectile becomes more and more apparent. Cast-iron shots were replaced by chilled iron years ago, and now forged steel has come to be regarded as the best material that can be used against armored ships or forts. The manufacture of steel projectiles has been carried to the greatest perfection in France, Germany, and England, and their great tenacity has been demonstrated on many occasions.

To give a single instance: In August, 1883, Sir Joseph Whitworth, in testing a 20-ton steel gun intended for the Brazilian iron-clad, *Riachuelo*, fired a 403-lb. steel shell through eighteen inches of wrought iron, thirty-seven inches of well-packed wet sand, one and one eighth inches of steel, various balks of timber, and about sixteen feet more of sand. *The projectile was recovered practically uninjured.*

Against hard armor, however, such as cast iron, steel, and compound, the superiority of steel projectiles is not so marked. This point will be discussed later on.

As to the results of these successive improvements: The ratio of the weight of the powder charge to the weight of the projectile has increased from about $\frac{1}{4}$ in the 100-ton gun of 1872, to $\frac{1}{2}$ in the 110-ton gun, and to nearly unity in the 19-ton Woolwich wire gun of 1884; the calibre of the heavy Armstrong guns has diminished from $17\frac{3}{4}$ inches in 1872 to 17 inches in 1882, and to $16\frac{1}{4}$ inches in 1884, yet the weight of the gun itself has increased; the initial velocity has increased from less than 1,700 f. s. to over 2,000 f. s., and the muzzle energy has been nearly doubled in the past twelve years.

Recent experiments have demonstrated the entire feasibility of firing shells containing nitro-gelatine bursting charges. Up to the present, such trials have been limited to six-inch shells holding about eleven pounds of nitro-gelatine; but there is manifestly no limit as to their use for curved fire with reduced powder charges, and it is highly probable that in future wars we shall have to encounter horizontal fire of this nature from the

heaviest guns. The development of this use of high explosives seems to rather favor the attack, and for distant bombardments it will be found most effective.

As regards the so-called dynamite guns, in which compressed air is used as the propelling force, while they may be found economical and even highly effective for certain purposes, their use against iron-clads will be very limited. Their penetrative power is slight, the range is limited, and it will be found very difficult, if not impossible, to throw charges of sufficient size to seriously affect side armor of moderate thickness. The gun is of great length and fires at high angles of elevation, which makes it difficult to secure good cover. No one supposes, nor does the inventor claim, that dynamite guns can ever replace heavy ordnance.*

The Gatling, Nordenfeldt, Hotchkiss, and other machine guns now constitute an important part of the armament of every man-of-war. Some of these guns are mounted in the tops, the gunners being protected by steel or iron shields, and in this commanding position their fire is extremely destructive when directed upon barbette batteries of low command. It is said that two of the Egyptian batteries at Alexandria were practically silenced by the fire of machine guns alone.

The number of iron-clads has, of course, greatly increased. Whereas England had but four such ships in 1861, she now has fifty-seven; and the six ships possessed by France in the same year have been increased to thirty-eight.

Such has been briefly the progress of the attack. Let us now see what we have been doing for our defences.

Soon after the close of the war, experiments were instituted to determine the best method of ameliorating our existing masonry forts to adapt them to the new conditions of sea-coast warfare. These finally culminated in the destruction of the Fort Monroe and Fort Delaware experimental casemates in the fall of 1868. The object sought was to increase the resistance of that portion of the scarp immediately surrounding the embrasure, which was necessarily the weakest portion of the wall. Substantial iron embrasure shields were tried, placed first, near the face of the scarp, and secondly, on the interior. In the first position it was

* The 8-inch gun, now nearly completed, is 60 feet long, and will fire a 75-lb. shell containing 125 lbs. of nitro-gelatine. (Total weight, loaded, 200 lbs.) It is expected that a 2,000-lb. pressure will give an initial velocity of 1,200 f. s., and a range of two miles at an elevation of 30°.

found that the transmitted shock of the projectile was sufficient to detach fragments and splinters on the interior and in some cases even entire stones, which were hurled across the gun chamber to such an extent as would have endangered the lives of any gun detachment had the casemate been so occupied. In the second case the iron shield gave better protection to the interior, but on the exterior the masonry was rapidly smashed to pieces and the embrasure soon became choked by the débris. Ultimately the entire wall between the piers was demolished and the interior fully exposed. These experiments, while not entirely satisfactory, plainly indicated the great difficulties which would be encountered and the great expense which would be involved in the application of iron armor to our masonry forts.

Recent experiments have shown that the 80-ton gun projectile will penetrate twenty-five feet of granite and concrete masonry or thirty-two feet of best Portland cement concrete, and it is now universally admitted that no masonry should be exposed to such fire; but in 1868 the development of guns and armor was still in its earlier stages, and the condition of our finances did not permit of great outlays in experimental constructions. Earthen barbette batteries were therefore provisionally adopted.

Our armament at this time consisted mainly of smooth-bores, and for this reason the earlier works were built with slight command. Batteries were commenced in all the important harbors, but work progressed slowly, owing to the limited annual appropriations, which fell to $725,000, in 1875, and then entirely ceased. Since 1875 not one penny has been appropriated for the *construction* of sea-coast defences. The annual appropriation of $100,000 for *preservation* and *repairs*, increased to $175,000 since 1881, has not even sufficed to preserve our *unfinished* works, and our defences are actually in a worse condition to-day than they were ten years ago.

The fire of machine guns and small-arms, together with the shell and shrapnel fire of the large guns and the greatly increased length of modern breech-loading ordnance, have made the service of barbette guns in low batteries an impossibility, and in batteries with greater command so difficult as to be practically impossible, without extensive modifications looking towards security of cover for the cannoneers. The penetration of projectiles has greatly increased, and it is now estimated that seventy feet of compact sand, or equivalent thickness of other material, is necessary to

stop the heaviest projectiles at close range. Increased thickness of parapets and traverses, bomb-proof shelters for relief detachments, thoroughly protected magazines, good shelter for the cannoneers, and arrangements for depressing carriages must all be made before our batteries can be considered as even ready for modern armaments.

TABLE II.

APPROPRIATIONS FOR FORTIFICATIONS SINCE 1866.

Year.	Appropriation.	Object.	Year.	Appropriation.	Object.
1866	$1,495,000	For construction, preservation, and repairs, including purchase and surveys of sites.	1876	$100,000	For protection, preservation, and repairs.
1867	1,080,000		1877	100,000	
1868	200,000*		1878	100,000	
1869	200,000*		1879	100,000	
1870	1,311,500		1880	100,000	
1871	1,627,500		1881	175,000	
1872	2,037,000	* Contingencies of fortifications.	1882	175,000	
1873	1,579,000		1883	175,000	
1874	719,000		1884	175,000	
1875	725,000		1885	100,000	
Total.	$10,974,000	For construction.	Total.	$1,300,000	For repairs, etc.

Insufficient appropriations have also retarded the development of our heavy ordnance, and while other nations have been making great progress in this respect, we, at the present moment, do not possess a single modern rifle.* For the defence of our entire coast, we have only the following armament: (1) About 150† 8-inch rifles which have been converted from the old 10-inch smooth-bores. These guns fire projectiles weighing 180 lbs. with 35 lbs. of powder and can penetrate 8 inches of iron at 1,000 yards. (2) About 310 15-inch smooth-bores. (3) A considerable number of smooth-bores of smaller calibres and some cast-iron Parrott rifles. (4) One modern 12-inch rifled mortar and a number of smooth-bore 10- and 13-inch mortars. It has been proposed to convert the 15-inch Rodmans into 11-inch breech-loading rifles, and several have been so converted, but I believe this project has been abandoned since the Sandy Hook experiments of 1883 showed that this gun, when fired with 130 lbs. of hexagonal powder and a steel or chilled cast-iron projectile, gave an initial velocity of 1,576

* Several modern steel rifles of 8- and 6-inch calibres are now being constructed, but none are as yet completed; naval guns are of course not included.

† Fifty more are now in progress of conversion.

feet and a penetration of 10 inches of wrought iron at 1,000 yards. The shortness of the gun makes it difficult to completely consume a large powder charge, and the shape and size of the projectile cause its velocity to diminish rapidly with the distance; but still the results given above show that the 15-inch smooth-bore as well as the 8-inch rifle are useful as subordinate weapons. We cannot, of course, depend upon them alone; a modern iron-clad could lie beyond their effective range and destroy such works as we have by piecemeal, dismount our guns, and drive away our gunners.

Although appropriations have been made for the construction and testing of various experimental guns, and boards have been constituted whose labors have resulted in the accumulation of much useful and important data, and whose reports have contained urgent and specific recommendations, Congress has thus far taken no decided action toward providing a suitable armament for our sea-coast defences.

As the Italians were fourteen and one half months in constructing their first 100-ton gun, and the English took sixteen months to build their first 80-ton gun, it would seem the part of wisdom to begin the purchase or manufacture of our heavy ordnance at once.

In one respect only have we made satisfactory progress. Our system of fixed torpedoes has been gradually developed by experiment and practice, and is now at least equal to any in the world. Plans for the torpedo defence of every important harbor have been prepared and filed ready for use, and torpedo cases, anchors, and such heavy and imperishable parts of the apparatus are being gradually stored in the various works where they are needed. Electrical operating-rooms, with shafts for submarine cables, are being prepared as rapidly as the yearly appropriations permit, and the torpedo corps (Engineer Battalion at Willets Point) has recently been increased to 400 men.

But it should be remembered that torpedoes are of little value without adequate land defences, and in this respect we are lamentably deficient.

For a number of years past careful experiments have been carried on at Willets Point with the Sim's electrical fish torpedo —a type of the offensive class. These torpedoes can be controlled and steered from the shore while travelling at a speed of from ten to twelve miles an hour, have a range of two miles, will

penetrate or dive under any ordinary obstruction, and carry charges of four hundred pounds of dynamite, which can be exploded at will or by contact. Weapons of this class should be provided as auxiliary defences of our harbors, but at present we have but the single experimental one.

Such is briefly the history of our sea-coast defences, and such their condition to-day. "With old casemated works designed long before the introduction of the 800- to 2,000-pounder rifled guns into modern warfare; their walls pierced for guns long since out of date; without iron armor or shields, and but partially armed, even with the old ordnance; with old earthworks, some of them built in the last century; with new ones for modern guns and mortars but partially built, and rapidly being destroyed by the elements by reason of their incompletion; with gun batteries without guns, and mortar batteries without mortars; with no carriages whatever for barbette guns of large size, except such as require the cannoneers to load from the tops of parapets, from which they can be picked off in detail by the enemy's sharpshooters; we can make but a feeble defence." * There is not a harbor on our coast that cannot be captured with comparative ease by an iron-clad fleet properly armed and equipped; there is not a single important power in the world which does not possess such a fleet.

PART II.—NECESSITY FOR SEA-COAST DEFENCES.

The great increase in cost of war material during the past century is most striking. In 1873, the British navy included about 118 actual sea-going line-of-battle ships, representing a total original outlay of about twenty-two millions of dollars or $187,000 per ship. Now England has only fifty-seven sea-going armored ships, yet their original cost, for hulls and machinery alone was over ninety millions of dollars. Since 1878, every new armored ship has cost England over two millions, while each of the recent Italian ships represents an outlay of over three and a half millions.

In the revised report of the Board of Engineers on the defence of the sea-board, dated March 24, 1826, the total cost of all works for the defence of the entire coast from Mount Desert Island to the Louisiana frontier was estimated at $16,537,454. Now the Board asks for seventeen and one-half millions to defend New York harbor alone.

* Report, Chief of Engineers, 1880.

One of the results of these increased expenditures has been the establishment of war on a financial basis. It has been truly said that "the modern system is to make war sudden, sharp, and decisive, and *to make the beaten party pay expenses.*" A large war indemnity has now come to be regarded as one of the essential articles of a treaty of peace. As war becomes more expensive yearly, *the cost of defeat increases proportionally.* Germany exacted a billion of dollars from France in 1871, and under similar circumstances we would probably have to pay even more.

Omitting all coast-defence vessels and unarmored cruisers, England has at the present time, 57 ships; France, 38; Russia, 16; Italy, 14; Germany, 13; Turkey, 14; Austria, 9; Holland, 7; Denmark, 6; Spain, 5; Brazil, 5, and Chili, 3; all sea-going, armored ships with powerful armaments.* The number of unarmored ships is, of course, far greater. Should we be so unfortunate as to become involved in war with any one of these powers, their navy would soon be on our coast. To those who remember the panic which swept our northern cities when the telegraph brought the news of the appearance of the *Merrimac* and the result of the first day's battle in Hampton Roads, and the universal feeling of relief from great and unknown disasters which followed the plucky fight of the *Monitor*, it is not necessary to enlarge upon the effect which would be produced by the knowledge that not one but twenty or even fifty such monsters were hurrying to our destruction with all the speed of steam and sail. The prostration of all business and the decline of all securities which would certainly follow a declaration of war, should we remain in our present defenceless condition, would represent a loss which cannot be estimated. Then would we appreciate the significance of the trite but ever important adage: "*In Peace, prepare for War.*"

The objectives of such fleets would be our commerce, our military and naval establishments, and our large cities. The first they would capture, the second destroy, and the third lay under contribution.

A hostile fleet lying in the upper bay of New York would have within reach of their guns about two billion dollars' worth of destructible property in New York City alone, and including Brooklyn and Jersey City, over two and a half billions. These guns would be of the largest calibre, many of them capable of throwing 16- and 17¾-inch shells charged with 75 pounds of ex-

* See Table III., Foreign Armored Ships.

plosive gelatine. Should the enemy resort to a bombardment in order to enforce his terms, the result would be terrible beyond description. Even when we read of the havoc wrought by a few pounds of dynamite in the public buildings of London, we have but a slight idea of the completeness of demolition which would result from the explosion of 75 pounds of nitro-gelatine in the interior of such a building as the New York Produce Exchange. There are within gunshot of this room eight buildings,* the assessed valuation of which for 1885 was over twelve millions of dollars. Every one of these might be totally wrecked by just eight happily directed shots. Yet the value of these eight buildings alone would more than suffice for the complete defence of the southern entrance to New York harbor, including works, armaments, and torpedoes of the most modern type.

But the effect produced by shells alone would be insignificant in comparison with the sweeping destruction resulting from the fires caused by their explosions. No fire department, however efficient, could check the progress of the flames, extinguished at one point only to break out at another, even should the men attempt such a hopeless and dangerous task. *New York would be doomed.* It is probable that any terms would be accepted in preference to such a bombardment, and two or three hundred millions would be a small price to pay for exemption from such a calamity.

This is not an exaggerated picture. It is a fair statement of what we have to expect in case of a foreign war, and it places squarely before us the value of what we have to defend here in New York harbor. We must face the alternative of the ransom or the bombardment. No rules laid down by closet students of International Law will protect us; history teems with examples of the destruction or confiscation of private property in time of war. The bombardment of Paris in 1871, of Alexandria in 1882, and the French operations in China at the present time, are recent examples of how little consideration is accorded to private interests. The truth is that war knows no inflexible law but that of necessity, and necessity would compel such a bombardment as I have pictured as the only means of enforcing the payment of a ransom. If sufficient time were allowed for the removal of non-combatants, women and children, humanity could expect no more.

* Produce Exchange, Mills, Equitable, Boreel, Mutual Life, and Western Union buildings, the Astor House, and the old Stewart Building (Broadway and Chambers Street).

I have prepared a table giving the value of all destructible property within the reach of an enterprising enemy, in eight of our wealthy seaports.*

This table has been compiled with care, and, while great accuracy is not claimed, it is as nearly correct as possible, considering the uncertain and variable quantities which are involved. All figures and estimates are for the year 1884, and have been obtained from Collectors and Receivers of Taxes, Boards of Assessments, Collectors of Ports, Annual Reports of Tax Departments, and other official documents of a similar nature.

In these eight harbors there is a grand total of four and a half billion dollars' worth of destructible property without any adequate security against the vicissitudes of war.† The continued indifference of the general public to the condition of our sea-coast defences, with such great interests at stake, is indeed difficult to comprehend. Where their personal interests are so directly involved, they are not wont to be so short-sighted.

New York City pays over one and a half millions annually for one of the most efficient fire departments in the world. As a consequence, the total losses by fire, in *insured* buildings and contents (which comprises nearly all the city), have only amounted to sixty-six and a half millions of dollars in the past twenty-eight years. The Secretary of the New York Board of Fire Underwriters‡ estimates this to be fully ninety per cent. of the total value of property destroyed by fire during that period. On this basis, the total losses in one hundred years would amount to about two hundred and sixty-four millions. Yet New York pays an average of over six millions§ annually for insurance against fire, or a total of eighteen millions *every three years.* One outlay of seventeen and a half millions would complete the entire defence of the Narrows and East River to the full extent recommended by our engineers, and the works once completed could be maintained by merely nominal annual appropriations.

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* See Table IV.—Value of Destructible Property Exposed to an Enemy.

† It is interesting to note that the value of destructible property is approximately $1,000 for each unit of population.

‡ I am indebted to Mr. William M. Randall for valuable statistics compiled from sworn statements on file in his office.

§ The average for the past eighteen years is $6,267,361.48. The annual premiums have varied but little during that period, the greatest being $8,281,508.75 in 1873, and the smallest $4,608,789.65 in 1878.

TABLE IV.

VALUE OF DESTRUCTIBLE PROPERTY EXPOSED TO AN ENEMY.

City.	Population by census of 1880.	Total assessed valuations for 1884. Real estate and personal property.	Value of real estate after deducting value of land.	Value of personal property after deducting non-destructible portion.	Exempt and untaxed real estate, deducting land value	Exempt and untaxed personal and movable property.	Total value of destructible property.	Remarks.
Portland . .	33,810	$32,808,735	$15,595,725	$9,611,548	$2,590,000	$5,348,181	$33,145,454	Local estimates
Boston . . .	362,839	682,648,000	195,252,280	154,517,300	36,745,543	88,955,275	471,470,398	of land valuations
Cambridge * .	82,508	90,000,000				Estimated.	60,000,000	differ considerably
Newport . .	15,693	27,543,600	10,613,700	5,052,960	2,858,000	5,717,000	24,241,660	for different cities.
New York . .	1,206,299	1,338,298,343	746,507,731	174,829,397	199,270,545	734,695,370	1,855,303,043	Many items are
Jersey City .	120,722	64,494,850	38,865,211	3,757,626	24,979,108	46,102,217	113,704,162	partially estimated
Brooklyn . .	566,663	317,853,850	198,084,296	16,581,925	96,939,074	293,878,148	605,483,473	from known values
Philadelphia .	847,170	583,612,683	382,485,404	7,907,662	92,527,757	306,344,568	789,265,391	in other cities.
Baltimore . .	332,313	249,651,699	76,606,445	46,508,469	27,428,570	68,571,430	219,114,914	In all items the
New Orleans .	216,090	160,000,000	87,600,000	14,000,000	21,865,116	52,932,000	176,397,116	full value of the
San Francisco .	233,959	244,987,559	47,830,975	52,130,658	23,687,000	57,343,000	180,991,633	land is deducted.
Totals, .	4,318,066						$4,529,117,244	

* Including Chelsea and Brookline; all exposed to a fleet in Boston Harbor.

War may do this city more injury in one day than would fire in a century. Such being the case, if insurance against fire is worth eighteen millions triennially, is not insurance against war worth a single payment of seventeen and a half millions?

It is not contended that fortifications should be erected in every harbor along our four thousand miles of coast-line. Our present defences are limited to only thirty * rivers, harbors, and bays, and the increased cost of iron defences will tend to reduce even this number. Modern fortifications should be erected in those harbors only, where the importance of the defence would be commensurate with its cost. But it must be understood that it is not security of property alone which we should seek; fortifications have other requirements.

Our merchant-men, and even our navy, must have secure harbors of refuge at intervals along the coast. The enemy must not be permitted to possess himself of secure and commodious harbors in our own waters, which he can convert into bases of operations, harbors of refuge, places of rendezvous, and supply, and, to a certain extent, repair stations. This point is of special importance inasmuch as iron-clads have far less coal-carrying capacity than other ships,† and with the exception of England, which has the fortified stations of Halifax, Bermuda, Jamaica, and Antigua on the Atlantic coast, and the naval port of Vancouver on the Pacific, no foreign power could maintain a hostile iron-clad squadron on our coast without the continual use of coal transports.

On the other hand, certain harbors are of great importance to ourselves as naval stations or naval strategic points. Such a harbor is Hampton Roads. It would be impossible to exclude the enemy from Chesapeake Bay, but a small fleet of war ships, monitors, gun and torpedo boats, lying under the secure protection of permanent works located at and around Old Point Comfort, would go far towards paralyzing any operations which the

* The Penobscot and Kennebec rivers; the harbors of Portland, Portsmouth (N. H.), Boston, and New Bedford; Narragansett Bay; the harbors of New London, New Haven, and New York; Delaware River; the harbor of Baltimore, and approaches to the capital *via* the Potomac River; Hampton Roads; the harbor of Beaufort, N. C.; the mouth of the Cape Fear River; the harbors of Charleston and Savannah; Cumberland Sound; the harbors of St. Augustine, Key West, Dry Tortugas, Pensacola, and Mobile; Ship Island; the mouth of the Mississippi, and the other approaches to New Orleans; the harbor of Galveston; the bays of San Diego and San Francisco; and the mouth of the Columbia.

† Vessels of the *Alexandra* class can barely carry sufficient coal for *four* days' steaming at full speed.

enemy might undertake in the upper bay. The case would be analogous to that of a land fortress near the line of operations of an army, and the enemy would be compelled to detach a fleet of observation or reduce the works before advancing. In addition, Hampton Roads is one of the most commodious and safe anchorages on our coast, and would be used as a naval base in case of war.

Perhaps one of the strongest arguments in favor of sea-coast fortifications is the fact that complete protection means not only security of property, tranquillity of business, and facilities for offensive operations in case of war, but it also means protection against war itself. History shows that there is no surer means of avoiding war than by such a thorough preparation as leaves no weak point exposed to an enemy's attack, and no temptation to his cupidity. "Invulnerability to all attacks, except those of an extraordinary character, is the most perfect insurance attainable by a powerful and peaceful nation against the calamity of war" [Report Mil. Com. H. R., April 23, 1862]. Our present condition is well known abroad, and would be far from conducive to a peaceable or honorable settlement of any delicate international or diplomatic question which might arise. A nation that would not hesitate to attack us now, however, would think twice before engaging in such a struggle were we armed and ready at all points.

And now a few words as to the arguments which we see so constantly urged against the construction of permanent sea-coast fortifications. These are principally:

(1.) That the navy should constitute our defence.

(2.) That torpedoes alone will suffice to close any channel.

(3.) That earthen batteries of sufficient strength can be hastily thrown up in the event of war.

There are indeed others who talk vaguely of "millions of strong arms being ready for our defence," but the absence of any definite suggestions as to how these "strong arms" are to be made available against iron-clad fleets leaves us nothing to discuss.

A perfect defence would always require the use of torpedo boats, gun-boats, monitors, and even ships-of-war in addition to land fortifications, but I do not think that any officer, either military or naval, would advocate a purely naval defence. It would be objectionable, first, because the sphere of action of our navy is, or ought to be, essentially offensive, and they should not be tied down to our own coast, leaving the enemy free to sweep our

commerce from the seas. The memory of our glorious naval victories during the War of 1812 should be sufficient to prevent any attempt to restrict our navy to such a passive rôle. And, second, because guns on fixed land supports possess certain decided advantages over guns on floating supports. These advantages are: less original cost; less cost of maintenance; less rapidity of deterioration; greater accuracy of fire; certainty of position and availability at the critical moment; invulnerability to the attacks of modern improved torpedoes such as the Whitehead; and freedom from such accidents as collisions or grounding which may cause serious injury to naval batteries or even their total loss.

To completely protect our coast by the navy alone would require a fleet in each harbor at least equal to the enemy's fleet, since we cannot foresee the point of attack; and even then the forces being equal we would simply have the advantage of the defensive, while defeat to us would mean not only the loss of our fleet but also of the place to be defended. It is needless to say that we shall never possess a navy of such strength.

The practice of all nations has been to defend their coasts by permanent fortifications, and unanimity of opinion on such a point is always a safe guide.

Entire ignorance of the nature and object of torpedoes could alone excuse such an argument as the second. Torpedoes have been introduced into defensive warfare to offset the advantages gained by the attack in the invention of the screw propeller. Their function is simply to prevent the enemy from running by the batteries, and to hold him under the close fire of the guns in case of such an attempt. They are not self-defending, and unless protected by land batteries will offer but a slight obstacle to an enterprising enemy. Electrical torpedoes are dangerous only so long as the connecting cables are continuous from the torpedoes to the battery on the shore. If these arteries be severed, the torpedoes, deprived of their life-giving current, become inert and harmless buoys. Whatever be the system, a single ship may blast a way through the lines and buoy a safe channel for the balance of the fleet. These operations would be comparatively simple if unopposed, but would be nearly impossible in the face of modern batteries with modern armaments.

I doubt whether the advocates of extemporized earthern batteries have ever figured upon the time necessary to construct such works. Should it unfortunately happen to be the winter

season, no earthworks at all could be constructed on our northern coasts; and even under favorable circumstances, making the most extravagant estimates, allowing the largest available force and working both day and night, it would still take over a week to construct even the seventy-foot parapet. Long before the expiration of that period the enemy might be upon us. Bermuda is only seventy-one hours' steaming from Savannah, sixty-six hours from Charleston, and fifty-eight hours from New York. Thirty-one hours would bring a British fleet from Halifax to Portland, and thirty-six hours to Boston. A Spanish fleet in Havana would only require forty-five hours to reach New Orleans, and ninety-six hours from Vancouver would place a British fleet in front of San Francisco. But even granting that the parapets may be finished (and much would depend upon the length of the negotiations preceding the declaration of war, and upon the use made of this time), of what use would they be without guns, and where would we obtain our armaments? Should we to-day send our order to Krupp or Armstrong, it would be three years before we could obtain guns sufficient for the defence of New York harbor alone. It would take much longer to manufacture them ourselves, as at present we have neither the necessary machinery nor experience.

Again, even should we have the good fortune to complete our batteries and the foresight to procure our guns in times of peace, how would we mount them? This is one of the most difficult questions of all, and yet, strange to say, the one least considered. One-hundred-ton guns cannot be mounted on wooden platforms like siege pieces. Depressing carriages are a *sine qua non* for barbette guns, and such carriages weigh nearly as much as the gun itself. The ordinary carriage of the 110-ton gun weighs ninety tons, or the gun and carriage together weigh two hundred tons. Large masses of masonry, with deep, broad, and secure foundations, are necessary to bear such weights. The only attachment of the carriage to this platform is a single iron or steel bolt or shaft called the pintle, around which the carriage revolves to permit of loading and pointing. The pintle must be solidly anchored in this masonry platform, and no mere mass of concrete hastily mixed and placed would stand the strain to which it would be subjected in action. The muzzle energy of the 110-ton Elswick gun is 50,924 foot-tons, or, in other words, should the projectile encounter some obstruction just as it leaves the gun, it would have the same

power to produce smashing or penetration as would a solid column of cast iron of the same diameter, one mile long, falling from a height of thirty-three feet and striking on its end. The phenomenon of recoil is familiar to all, but few realize what this word means in the case of heavy ordnance. Omitting from consideration the weight of the top carriage, the gun would be impelled backwards with a velocity of fourteen feet per second, by the same force which imparts a velocity of 2,020 feet per second to the 1,800-pound projectile. If any one can conceive of the power required to suddenly stop this mass of 246,400 pounds moving at the rate of fourteen feet per second, he will have some idea of the tremendous strain thrown on the pintle. The modern tendency is to hold the gun well up to its work, and to limit the recoil to a very short distance. Vavasseur's rule is to allow only three calibres recoil, and with some of the smaller guns Krupp permits practically none. The effect of this is to theoretically slightly increase the velocity of the projectile, but practically to economize space and to greatly increase the *shock* on the pintle. The recoil is checked by the aid of friction and hydraulic buffers, and the pintle is somewhat assisted by deeply grooved chassis wheels and other devices; but however the strain may be regulated or distributed it is still enormous, and no platform not composed of carefully cut stone, well bonded together and laid in good hydraulic cement, could stand it. It would require weeks to construct such a platform, even in the most pressing emergency, and months would be necessary for it to set and harden before it could be used.

Magazines and bomb-proofs, loading galleries and store-rooms, boiler- and engine-rooms, shell-lifts and machinery for loading and manipulating the guns must all be constructed or mounted, and must have secure cover against projectiles capable of penetrating 60 feet of sand or 32 feet of concrete masonry. Such works cannot be "improvised." The time necessary for their construction is easily estimated, and is measured by months, not days. If we wait for the commencement of hostilities, the war will probably be over before our batteries are ready for action.

I have devoted considerable time to the question of extemporized fortifications, as it seems to be the favorite argument of all those who give so little attention to this subject that they do not or will not realize our defenceless condition; who see no necessity for constructing harbor defences in times of peace; and who (as has actually been stated on the floor of Congress) "see no

indication that the food shall be taken from the mouth of labor to gratify the insatiate ambition of any man or body of men."

If such men would only devote a few moments to the consideration of the practical difficulties of such hasty constructions, some of which I have endeavored to portray, we might hope that our next war would not find us entirely unprepared.

It is always difficult to foretell what the future may bring forth, but every thing indicates that the limit of armored plating for war ships is about reached. Twenty-five inches of wrought iron is the greatest thickness yet attained with that metal, and we have already reached nearly the same thickness with steel. A few more inches and the flotation will be cut down to the minimum limit. Referring to the Spezia trials of last October an English authority says: "The advent of forged steel projectiles has demonstrated once more the incomparable superiority of the gun over armor, and has suggested to many the necessity of either proceeding to armor of a minimum thickness of 24 inches, or else of abandoning it altogether."

The future of heavy ordnance is not so easily predicted. The difficulty of mounting and manœuvring guns of great weight must ultimately limit progress in this direction, but we may undoubtedly look for improvements in other ways. Heavy guns are now made entirely of forged or compressed steel, but of late steel wire has been regarded with more favor, and it seems at least possible that the wire gun, so long and so persistently advocated, and so systematically neglected, may become *the* gun of the future.

Improvements in powders and means and methods of ignition may, in time, give us greater velocities, and, therefore, greater power than we now obtain, with perhaps even smaller guns. We already use a powder charge nearly equal in weight to the projectile, and nothing indicates that we shall stop at this point. With heavy powder charges, however, the recoil becomes a serious consideration, and weight in some shape is necessary to sustain it.

But none of these possible changes requires further delay in the construction of coast defences, while every thing points to the necessity of immediate action. General Newton says: "For the first time in the development of the modern art of war, the engineer has solved, with mathematical certainty, the problem of closing harbors and rivers against hostile ships, so that the sole question in each particular case would be whether the importance of the place would justify the cost." The bloodless battle be-

tween guns and armor has been well fought on the trial grounds of Europe, and the time has now come when we should profit by the result and begin to put our house in order against any emergency. It is true that our horizon is not yet darkened by the war-clouds that hang so threateningly over Europe, but no one can foresee when war may come, and history, including our own, teaches us that even the most just, equitable, and upright policy will not always avail to preserve the blessings of peace. We should not commit the folly of waiting till the time for preparation is past and the hour for action is upon us.

PART III.—MODERN SEA-COAST DEFENCES.

A complete system of sea-coast defences consists of three lines. The outer line is composed of war ships; the second or skirmish line of torpedo boats; and the third or inner line of land fortifications and channel obstructions, usually fixed electrical torpedoes. Besides these, there should be a reserve of war ships, torpedo boats and launches, gun-boats, etc.

The first two lines and the reserve constitute the naval defence. The outer line is frequently wanting, either through accident, or design, or lack of ships. The second line is a comparatively recent addition to the defence, but has been adopted by all nations, and now constitutes a most important part of the system.

The torpedo boats of this line are light and handy, have great speed, and are built of steel, with low free boards and flush decks, when possible, so as to expose a minimum surface to the enemy. First-class boats are ordinarily "about 100 feet long, with a draught of from 4½ to 6 feet of water; a capability of maintaining a speed at sea of not less that 16½ knots; an endurance at this speed of over 150 miles, and a maximum endurance of from 650 to 1,200 miles; an armament of torpedoes and revolving cannon; and a capability of keeping the sea under all conditions of weather." * Whitehead torpedoes are almost exclusively used with these boats, and are discharged by means of compressed air or steam from under-water tubes permanently built into the bow, or in some cases from torpedo guns on deck. Second-class boats are smaller, being from 50 to 80 feet in length, and those of minimum size constitute a part of the equipment of a first-class man-

* Lieut. Very's "Report on Torpedo boats for Coast Defence," August, 1884. Recent torpedo-boats are built with greater dimensions than those given, and develop a speed of from 20 to 22 miles an hour.

of-war. The average cost, including armament, has been placed at $57,000.

A fleet of these boats, if superior to the enemy's torpedo fleet, would effectually prevent the close blockade of any harbor, as a blockading squadron would be forced to haul off the coast at night for fear of their attacks.

All foreign powers are expending large sums in the construction of torpedo boats. In 1883, including those building, England had 129, France 76, Russia 125, Italy 53, Holland 24, Norway and Sweden 15, Austria 14, and Denmark 9. Germany is rapidly completing a fleet of 150 boats, and other powers are continually increasing their fleets. These figures are sufficient evidence of the general estimation in which this form of defence is held abroad.

At present we have no coast-defence torpedo boats of this class. Lieutenant Very estimates 90 * as the minimum number for effective resistance in case of war, and 34 as the smallest allowable peace footing.

The third line of defence is of course the most important—I may say the all-important. On this our chief reliance must be placed, and no efforts and no expense should be spared to make it complete and impregnable. The works of this line must be so located that the enemy cannot come within range of the objects to be protected without passing the line, and must be sufficiently strong to prevent him from forcing a passage. This requires that they should be placed at distances of not less than seven miles from our cities and navy yards; should be located at favorable (preferably narrow) parts of the channel; should be constructed with all possible strength; and should have armaments at least equal in weight of metal to those of any possible attacking squadrons; and that the torpedo defence should be so complete that no ship could attempt to cross the lines without incurring the risk of almost certain destruction.

The most common problem will be to close the channel leading to one of our large cities. We may expect the efforts of the enemy to be proportioned to the importance of the objective, and we must mount as many guns as can be brought to the attack, or compensate for any deficiency in numbers by increased power. The great cost of 100-ton rifles will limit the number of such weapons to that necessary to ensure the destruction or

* The German rule of one boat to each ten miles of coast line would require some 300 boats for the Atlantic coast alone.

serious injury of the heaviest-armored ships. Smaller and more rapid-firing guns will suffice for the weaker iron-clads and unarmored ships, and by multiplying these we can obtain the necessary preponderance of fire.

The works containing the heaviest guns should evidently be placed close to the bank, or even in the water, on natural or artificial islands, so that we may have the closest range and every chance of penetrating the enemy's armor and disabling his ships. Each round from the 100-ton gun costs from three hundred to one thousand dollars, according to the nature of the projectile; it is, therefore, of the greatest importance that such fire should not be wasted. As the enemy will attempt to clear the channel and run the gauntlet of the batteries, we should so arrange these defences that he cannot remove the torpedoes without remaining so long under our close fire that the issue shall not admit of a doubt.

Guns ranging from twenty to fifty and possibly eighty tons in weight should be placed in well-scattered batteries—some along the banks, so as to thoroughly command the channels of approach, and some on higher and more retired ground, where they have better protection and the advantage of a plunging fire. The position and armament of each battery will determine its method of construction.

The 100-ton gun batteries will usually have little command, and will be fully exposed to the enemy's fire. This requires the use of covered defences, and, as it is desirable to utilize to its full extent the great power of these expensive weapons, they should generally be mounted in revolving armored turrets.

The Board of Engineers "deems it advisable to make the armor of turrets or casemates not less than 36 inches thick, if of wrought iron, or of equivalent resistance, if of other material." On this basis, the estimated cost of a revolving turret for two 100-ton guns, complete, is given as $600,000 The estimated cost of the turret, *exclusive* of the armor, is $220,000.* The guns cost $100,000 each.

The low shore batteries must likewise be covered, and this again requires armored fronts. There are three classes of such

* Capt. Bixby, Corps of Engineers, U. S. A., gives the following estimates. Approximate cost of a turret for two 16-inch rifles, armored with 14-inch steel-faced armor or its equivalent, and furnished with steam or steam-hydraulic gear for the entire service of ammunition, guns, and turrets, but *without including cost of guns or foundations*, $200,000 to $300,000. This may be divided as follows: 20% for ordinary iron work, 35% for armor, and 45% for steam or steam-hydraulic machinery.

works: continuous armored scarp or iron-fronted batteries, armor shields with masonry parapets, and armor shields with earthen parapets.

The iron-fronted batteries are similar to our old granite forts, with a single tier of casemates, iron or other armor being substituted for the masonry scarp. The light over-head plates and concrete or earthen roofs are supported by iron columns, and this allows the guns to be spaced at comparatively short intervals; in one example of an English wrought-iron battery the distance between consecutive gun-ports being only eight yards, with a horizontal field of fire of 70°; while in drawings of Grüson's cast-iron forts the guns are spaced at intervals of only five and a half yards.

A contracted site might require two tiers of casemates to afford the requisite volume of fire. Such batteries could be constructed with wrought-iron scarps, though they possess manifest disadvantages, and should always be avoided, if possible.

The Board of Engineers estimate the cost of single-tier wrought-iron casemated batteries at $100,000 per gun. Breech-loading rifles of about fifty tons' weight would be mounted in these works, and such guns cost $50,000 each.

Masonry parapets with iron embrasure shields have been used in the past, but excepting in England they have few advocates at the present time. No masonry walls can withstand the fire of modern ordnance.

Earthen parapets with iron shields constitute a far more efficient form of battery, the Grüson cast-iron and English wrought-iron shields being well-known types of this class. The shield permits of the reduction in thickness at the embrasure which is essential for lateral range; and the use of earthen merlons, between which the shield is fixed, makes this battery more economical than the continuous iron-fronted works. The thick merlons, however, require a great development of front for a small number of guns; in actual examples the guns being spaced at average intervals of twenty yards, and great difficulty is found in securing an unyielding connection between the shield, the parapet, and the floor of the gun chamber. These are serious objections. No form of battery involving the use of shields is recommended by the Board of Engineers.

The Shoeburyness experiments of 1883 have indicated a method by which our existing masonry forts can be made effective.

though the advisability of such reconstructions is more than doubtful.

These experiments had for an object the determination of the amount of protection afforded to granite walls by armor plates. A 1,700-lb. Palliser chilled-iron shell from the 80-ton gun, with a striking energy sufficient to penetrate 25 inches of wrought iron, failed to completely penetrate a 12-inch Cammell compound plate. This unexpected result was due to the rigid backing, 22 feet of granite and concrete, and to the excellence of the plate. Col. Inglis, R.E., says: "Considerable importance attaches to this trial, because it has certainly shown an effectual way of making existing masonry proof against any battering guns that can ever be produced, though the great expense of armor-plating large surfaces makes it very desirable that some less costly expedient should be found effective."

The five-foot wall around the embrasures of our granite forts would certainly not afford the rigidity of backing which was evidently so effective in this experiment. Plates of much greater thickness than 12 inches would have to be used, and even should the plate not be penetrated when struck by a heavy projectile, it is certain that the granite blocks would be hurled through the casemate by the transmitted shock, as in the experiments of 1868. Moreover, our masonry forts were constructed for the old muzzle-loading 8- and 10-inch * smooth-bores, and to adapt them to the service of modern 50- or even 30-ton breech-loading rifles would require such extensive alterations that taking all together it might even be cheaper to construct new batteries.

All iron defences should be lined with rope mantelets fitting closely around the guns, to deaden the effect of vibration and sound when the exterior is struck by a heavy projectile; to screen the cannoneers from fragments and splinters thrown off on the interior, and from small projectiles and missiles entering through the gun-ports; to reduce the effect of blast and concussion when the guns are fired; and, as far as possible, to keep the smoke from the gun-chamber.

For more retired batteries with commands of from 75 to 100 feet, earthern parapets may be used, the guns firing *en barbette*. The parapets will require a thickness of 70 feet of compact sand, or equivalent thickness of other material. Ordinary con-

* All works built subsequent to 1835 will hold 10-inch guns, and the latest of our granite forts were planned for 13-inch smooth-bores.

crete is estimated to have twice, and concrete containing large granite blocks, three times the resistance of sand. One or both of these materials should be used in the interior of the parapet. One traverse for each gun will be necessary, and these should be made high enough and thick enough to afford thorough protection to the magazines, loading galleries, engine and boiler-rooms, store-rooms and bomb-proofs, located in or below them. In recent projects prepared by the Board of Engineers, it is proposed to use breech-loading guns with depressing carriages, manœuvred by steam or hand power. The interior crest is to have a height of 16 feet above the terre-plein; the carriage is to permit of a vertical descent of 6 feet after firing; and the gun is then to be traversed parallel to the parapet on a front pintle, so that the breech comes opposite and near to the loading gallery under the traverse. The operation of loading can then be safely performed from the gallery. In this way, the gunner would be the only man exposed and he could be protected from machine gun and small-arm fire by a steel shield on the breech of the gun. To secure proper cover, the traverses have to be raised some 10 feet above the interior crest, and their great width requires the guns to be spaced at intervals of 41 yards. To obviate the conspicuousness of the mark thus offered, it is recommended that small trees and shrubs be planted on the exterior slope and in front of the parapet. The estimated cost of these batteries is $13,164 per gun.

For the defence of anchorages and roadsteads, and for confined positions where fleets must advance in contracted order or take fixed positions for attack, mortar batteries will play an important part. They attack the most vulnerable portion of the ship—that is, the deck; and the accuracy of fire has so increased since the introduction of rifled mortars that they now constitute a most effective part of our sea-coast armament. It would be impossible for a fleet to remain stationary for any length of time when exposed to the fire of modern 12-inch rifled sea-coast mortars.

These batteries should be placed on elevated and retired points which may not be needed for other purposes, and should be constructed with sunken terre-pleins and inconspicuous earthen parapets. Since the security of cover is complete, except indeed against similar vertical fire, economy of construction would dictate the massing of mortars in large batteries. This is recommended by all authorities. Modern rifled mortars cost about $15,000 each, but their emplacements can be prepared for

$2,000, and $17,000 will cover the cost of each mortar ready for action.

The increased thickness and weight of armor plating of modern war ships has resulted in the development of a class known as central battery or citadel ships, in which the armor protection is limited to the space containing the machinery and heavy armament. The remainder of the ship, both fore and aft, even at the water line, is left at the mercy of the enemy, and flotation is preserved by the use of water-tight compartments, filled with cork, and light deck armor below the water line. This system of construction has been frequently and severely assailed by competent critics. Only a few weeks ago Capt. Fitzgerald of the English Navy said: "From a naval point of view, it is a grave, nay a fatal error, to leave two thirds of the water lines of our line-of-battle ships absolutely unplated, and therefore certain to be penetrated in a hundred places by the terrible hail of light- and machine-gun fire which would be poured upon them in action; seeing that in this condition their seaworthiness would be at least doubtful." It is even asserted that the stability of these ships would be destroyed by the penetration and flooding of either the bow or stern compartments. The present tendency is to supplement the heavy armament of first-class ships by a considerable number of light breech-loading rifles,* rapid-firing and machine guns. If these weapons are useful in combats between iron-clad fleets they will be still more important in engagements between iron-clads and sea-coast fortifications, and the main advantages will be entirely on the side of the fortifications. Large numbers of such guns should be mounted in land batteries, to neutralize the enemy's fire; to discourage his sharp-shooters; to riddle the unarmored portions of his ship; to pour a stream of projectiles through every gun-port; to repel boat attacks; to assist in protecting the torpedo lines; and to defend our works from land attacks in flank and rear. As they are comparatively inexpensive, easily moved, and only auxiliaries to the main defence, they will not require such secure cover as the heavier guns. They should be so concealed from the enemy that he can only locate them by their fire, and may be mounted in earthern sunken batteries outside of, but not in line with the main works, keeping always in view the special purposes above mentioned and the advantage of a concentrated fire on the hostile fleet.

* The Italia and Lepanto are each to carry twenty-two 6-inch rifles.

In view of the important part destined to be taken by machine guns in future sea-coast warfare, the following brief description of these weapons may not be without interest.

1. RAPID-FIRING GUNS.—Strictly speaking these are not machine guns, but occupy a position midway between machine guns proper and small-calibred breech-loading rifled cannon. For naval purposes they are mounted on fixed stands permitting practically no recoil; are loaded by hand with fixed ammunition similar to that used with small-arms; are pointed rapidly and easily by aid of shoulder rests; and are provided with pistol grips and triggers for firing.

The first seventy-seven Hotchkiss guns of this class were delivered to the British Admiralty last month (April). They are 2.24-inches calibre; weigh 1,000 pounds each; and fire either chilled, common, or shrapnell shell, or case shot. The initial velocity is 1,900 feet per second; the projectile weighs 6 pounds, and will penetrate 4 inches of steel at 300 yards. Two men are required to serve each gun, and 12 aimed rounds can be fired to the minute.

The Nordenfeldt gun is similar to the Hotchkiss; and both manufacturers are prepared to supply much heavier weapons, whenever they may be required.

2. HOTCHKISS REVOLVING CANNON.—These are of three sizes—1.46-in., 1.85-in., and 2.09-in.; have five barrels each; and fire steel projectiles weighing respectively 1 pound, 2½ pounds, and 4 pounds. The barrels are revolved by a handle, one shot being fired at each revolution of the handle. About twenty aimed shots can be fired to the minute.

3. NORDENFELDT VOLLEY GUNS.—These are of several patterns, the heaviest being the two-barrelled 1½-inch calibre, weighing 450 pounds. This gun fires 22-ounce steel shot or shells at the rate of 40 volleys or 80 shots per minute. The initial velocity is 1,600 f. s., and the penetration 1½ inches of iron at 300 yards. The four-barrelled 1-inch guns used in the British navy weigh, with the mounting, 700 pounds, and fire 8-ounce projectiles at the rate of 65 volleys or 260 shots per minute.

4. GATLING GUN.—Number of barrels, 10; calibre, .65 inches; weight, 725 pounds; weight of lead projectile, 3¼ oz.; muzzle velocity, 1,427 f. s.; rapidity of fire, 1,200 shots per minute.

5. MAXIM GUN.—In some respects this is still an experimental weapon, but it bids fair to supersede all other varieties of

machine guns. The empty cartridge case is extracted, a new cartridge inserted, and the gun fired, all by the force of recoil from the preceding explosion; so that if one round be fired by hand, the gun will go on firing by itself so long as the supply of cartridges remains unexhausted. With a single barrel, it is said that this gun will fire 600 rounds per minute. The rapidity of fire is easily regulated by proper mechanism.

6. GARDNER GUN.—Number of barrels, 2; calibre, .45 inches; initial velocity of lead projectile, 1,280 f. s.; rapidity of fire, 357 shots per minute. Like the Gatling, this gun is fired by turning a hand crank, all the barrels being fired at each revolution of the handle.

No floating obstruction offers so serious an obstacle to the enemy as fixed electrical torpedoes. These should be planted by grand groups and skirmish lines so as to cover a wide area and render countermining, under the close fire of the batteries, a difficult and fruitless labor; and should be placed so close together as to make it an absolute impossibility for any ship to pass the lines without striking one or more torpedoes. A single touch would mean destruction. Electrical torpedoes have this advantage, that a single movement of the firing-battery switch renders the channel safe for our own vessels, and a similar reverse movement will close it in the face of an enemy. The electrical operating rooms must be placed in the most sheltered and secure positions in the works.

Mechanical torpedoes may be used to block one of several channels, or even the only channel in cases of emergency or in unimportant harbors, but such torpedoes, once planted, close the channel to friend and foe alike.

The torpedo lines must be well flanked, for protection against counter-mining and to prevent the enemy from removing the torpedoes or cutting the cables at night. This may sometimes be done by the works previously described, but in general, special flanking defences will have to be constructed. Such works should be placed in sheltered positions, protected from the enemy's distant fire, and should be armed with smooth-bores—firing grape and canister—and machine-guns. The former may be so arranged as to be fired automatically by any one disturbing the torpedoes in the line along which the gun is trained. Earthen parapets will generally suffice for such batteries.

The boat-houses and dynamos for the fish torpedoes, sunken

and floating channel obstructions of a passive nature, and electric lights and apparatus are component parts of the third line of defence.

The arrangements for the auxiliary defences would include boat-houses and air-compressors for torpedo boats; gun-boats; torpedo launches and pinnaces; guard and picket boats; and all the numberless details of a similar nature. Many of these could be improvised after the declaration of war; others would require previous and careful preparations; and all are of great importance to a vigorous defence.

To recapitulate: The defences of our important harbors should consist of three lines and a reserve.

1st line—War ships.

2d line—Torpedo boats.

3d line—Channel obstructions and land batteries.

Reserve—War ships, and auxiliary defences.

The land batteries of the third line are of six classes:

1. Revolving armored turrets, used where all-round fire is essential, containing the heaviest guns, and so placed as to ensure the destruction or serious injury of the strongest iron-clads which may attempt to force the line.

2. Iron casemated forts, used when all-round fire is not essential, containing guns of smaller calibres, and so placed as to thoroughly command the channels of approach, and to assist in maintaining the preponderance of fire necessary for a secure defence.

3. Earthen barbette batteries, to be used in connection with the foregoing works or as substitutes for them.

4. Mortar batteries, armed with 12-inch rifled mortars.

5. Machine-gun batteries, containing large numbers of modern rapid-firing and machine guns.

6. Torpedo flank defences, armed with smooth-bores and machine guns.

The extent, character, and locations of the fortifications, and the size and number of the guns constituting their armaments, will depend upon the circumstances and requirements of the defence, and will so vary with each locality that extended and detailed study will be essential for the proper application of this system to any particular harbor.

"If the water is so shoal as to permit the approach of light-draught vessels only, barbette batteries may suffice. Where the

channel is deep, but so narrow as to compel the ships to move up in single file and attack bow on, heavy guns should be mounted in iron casemates, supported by batteries of lighter guns mounted in barbette; but when the channel is both broad and deep, with ample room for the development of the attack, every available means of defence must be employed."* The full complement of torpedoes should be provided in all cases.

The advantage of all-round fire which armored turrets possess is so great that it has been estimated that when such fire is required two guns in a turret are equivalent to six guns in shielded or casemated batteries. Turrets may be advantageously placed on commanding points when such positions fulfil the conditions before given.

Iron-fronted batteries restrict the lateral range to 70° or less, and are very costly. Nevertheless they are essential in positions where suitable elevated sites cannot be obtained, and under any circumstances in important harbors where dependence should not be placed on open batteries alone. If properly constructed they can only be silenced by direct embrasure shots.

Open batteries possess manifest disadvantages. They are exposed to distant curved and vertical fire, and to small-arm and machine-gun fire at closer range. If depressing carriages be used, they will probably not suffer severely from the latter fire, but the long-range medium-sized rifled guns of the attack may do great execution. On the other hand, barbette batteries have the great advantages of limited cost and an unrestricted field of fire.

Table V.† gives the nature and estimated cost of the defences proposed for eight of our important harbors, the armament of these works, the value of the destructible property thus covered, and the ratio of the cost of defence to the value of the property protected.

NEW YORK HARBOR.

The defences of New York Harbor, as proposed by the Board of Engineers, are to consist of two revolving armored turrets on the site of old Fort Lafayette, and two similar turrets on the Staten Island side, each mounting two 100-ton guns; two casemated batteries, each pierced for ten 50-ton guns; two earthen barbette batteries, each armed with ten 20- or 30-ton guns mounted on disappearing carriages; and two mortar batteries mounting

* Report, Board of Engineers, 1884. † Proposed Harbor Defences.

TABLE V.

PROPOSED HARBOR DEFENCES.

Harbor.	100-ton guns mounted in revolving turrets.	50-ton guns mounted in iron casemates.	50-ton guns mounted in barbette batteries.	30-ton guns mounted in barbette batteries.	20-ton guns mounted in barbette batteries.	12-inch rifled sea-coast mortars.	Cost of iron turrets	Cost of iron-casemated batteries.	Cost of barbette batteries.	Cost of mortar batteries.	Total cost of gun emplacements.	Cost of armaments.	Total cost of forts and armaments.	Total cost of defence. Add 25 per cent. for cost of torpedoes and flanking defences, modifications of existing works and of sites.	Total value of destructible property protected.	Ratio of cost of defence to value of property protected.
Portland . .			20		20	48			$1,400,000	$96,000	$1,496,000	$2,120,000	$3,616,000	$4,520,000	$33,145,454	.136
Boston . . .	8	10		10	15	100	$2,400,000	$1,000,000	550,000	200,000	4,150,000	3,250,000	7,400,000	9,250,000	531,470,398	.017
Newport . .			10		10	48			700,000	96,000	796,000	1,420,000	2,216,000	2,770,000	24,241,660	.114
New York .	14	30		15	15	144	4,200,000	3,000,000	900,000	288,000	8,388,000	5,660,000	14,048,000	17,560,000	2,574,490,678	.007
Philadelphia .		10			10	16		1,000,000	300,000	32,000	1,332,000	940,000	2,272,000	2,840,000	789,265,391	.004
Baltimore . .		5			10	16		500,000	300,000	32,000	832,000	690,000	1,522,000	1,902,500	219,114,914	.009
New Orleans .	8		20		10		2,000,000		1,100,000		3,100,000	2,000,000	5,100,000	6,375,000	176,397,116	.036
San Francisco	10		20	71	5	96	3,000,000		3,080,000	192,000	6,272,000	5,670,000	11,942,000	14,927,500	180,991,633	.082
Totals .	40	55	70	96	95	468	$11,600,000	$5,500,000	$8,330,000	$936,000	$26,366,000	$21,750,000	$48,116,000	$60,145,000	$4,529,117,144	.013

forty-eight mortars each, The batteries are to be constructed on either bank in the vicinity of Forts Hamilton and Wadsworth.

This defensive line is distant about six miles from the Battery, and the works would command all approaches in the lower bay north of Sandy Hook. The channel is narrow, permitting the effective use of torpedoes and compelling hostile ships to pass within close range of the works on either bank. It is believed that these fortifications, together with the channel torpedoes, would make the line impregnable, but where so much is at stake every means of defence should be exhausted, and every possible auxiliary in the shape of war ships, monitors, torpedo boats, movable torpedoes, etc., should be provided.

Ships could not maintain a bombardment from any position within three or four miles' range of these works, and this would place them beyond reach of New York City. The extreme range of modern ordnance is not so great as is popularly supposed.

TABLE VI.

EXTREME RANGES OF MODERN HEAVY ORDNANCE.

Gun.	Elevation, 45°. Range in miles. Hélliés' formula.	Elevation, 38°. Range in miles. Hélliés' formula.	Elevation, 35°. Range in miles.		Elevation, 20°. Range in miles.	
			Bashforth's formula.	Hélliés' formula.	Bashforth's formula.	Hélliés' formula.
119-ton Krupp	10.184	9.990		9.779	7.407	7.642
110-ton Armstrong . .	10.331	10.134	9.592	9.929		7.746
100-ton Armstrong . .	9.487	9.300		9.105	6.817	7.042
80-ton Woolwich . . .	8.546	8.372		8.191	6.102	6.279
63-ton Woolwich . . .	10.405	10.208	9.536	10.003		7.816

Table VI. gives the ranges of some of the heaviest guns at different angles of elevation.* Many of the smaller guns have nearly equal ranges, but those given are sufficient to indicate a probable limit of less than eleven miles.

It will be noticed that the extreme range in the table (10.4 miles) is obtained with the 63-ton Woolwich gun when fired at an elevation of 45°. Such an elevation would, however, be impossible with naval guns of great weight, for even should the carriage permit, the deck could not be subjected to such a strain. An ele-

* Computed by Lieut. Bruff, Ordnance Department, U. S. A., by Bashforth's and Hélié's formulas. Ranges can only be approximately determined by computations; these are doubtless correct within a fraction of a mile.

vation of 20° is probably an extreme limit for heavy guns mounted on ships-of-war. This angle gives a range of 7.8 miles with the 63-ton gun, and 6.8 miles with the 100-ton gun. New York and Jersey City would therefore be completely protected from naval bombardment by the proposed defences, and Brooklyn to a great extent. There are, however, positions off Coney Island from which the suburbs and southern portion of the latter city could be reached.

But the enemy's fleet must enter the upper bay before he is in position to demand a ransom from these great cities. As has been shown, this would present no great difficulty in the present condition of our fortifications, but with the proposed system of defences it would be an impossibility.

The entrance from Long Island Sound is of scarcely less importance: it would not be necessary for a fleet to pass Hell Gate in order to have New York City at their mercy, and ships of any draught could proceed as far as Ward's Island without difficulty. It is proposed to construct revolving turrets (three), iron casemated batteries, barbette and mortar batteries, near the present forts at Willets Point and Trogg's Neck, mounting in all six 100-ton guns, ten 50-ton guns, ten 20- or 30-ton guns, and forty-eight 12-inch rifled mortars. These works, with the channel torpedoes, would effectually close this passage to any enemy.

Referring again to the question of ranges, the following data in reference to actual long-range firing may be found interesting, as practice is always more convincing than theory.

July, 1880. Italian 100-ton gun. Weight of projectile, 1,000 kilos; initial velocity, 451 metres; elevation, 15° 48′; range, 8,000 metres (5 miles).

August 17, 1883. Krupp's 30.5 c. m. gun (35 calibres). Charge, 162 kilos; weight of projectile, 455 kilos; elevation, 14°; range, 10,146 metres (6.3 miles).

July 31, 1883. Krupp's 26 c. m. gun (35 calibres). Charge, 87 kilos; weight of projectile, 275 kilos; elevation, 20°; range, 11,526 metres (7.2 miles).

French 34 c. m. gun. Elevation, 38°; range, 12,918 metres (8 miles). [Hélié.]

Woolwich 80-ton gun. Charge, 445 pounds; weight of projectile, 1,760 pounds; muzzle energy, 33,710 ft.-tons; elevation, 10°; range, 6,251 yards (3.5 miles).

Report of Sept., 1884. Krupp's 24 c. m. mortar. Charge,

5.4 kilos; weight of projectile, 136 kilos; for elevation of 30°, range equal 3,314 metres (2.1 miles); for elevation of 60°, range equal 3,119 metres (1.9 miles). Five shots were fired at each angle. At 30° the mean divergence was 11.9 metres in range, and 0.5 metres laterally; at 60° the mean divergence was 6.6 metres in range and 5.8 metres laterally.

PART IV.—THE QUESTION OF ARMOR.

For land defence the question is simply how to obtain secure cover at a minimum expense. Any one of the various forms of armor will afford complete protection if sufficient thickness be used, but the cost will vary within wide limits. For naval purposes, the weight of the armor must be the ruling consideration, and the question of expense is subsidiary thereto. Discussions and conclusions concerning the use of armor for war ships do not therefore of necessity apply to land batteries.

The four principal varieties of armor plates may be briefly described as follows:

1. STEEL PLATES.—These are principally manufactured by Henri Schneider & Co., of Le Creusot, France. Strictly speaking the material is not steel but semi-steel, steely iron, homogeneous metal, or soft steel, as it is variously designated; the proportion of carbon being about .45 %. The plates are forged under heavy hammers, which operation reduces the thickness as much as 77 %, then tempered by immersion in colza oil, and afterwards annealed. They combine great resisting power with great tenacity.

2. COMPOUND PLATES.—These consist of wrought-iron foundation plates with steel faces. The iron gives the requisite tenacity, and the steel the hardness which determines the resistance to penetration. The steel face comprises about one third of the total thickness, and is applied in two ways, by the Ellis and Wilson patents. The principal manufacturers of the Wilson plates are Charles Cammell & Co., Sheffield, England. Molten steel is poured on the wrought-iron plate, and after cooling the combined plate is rolled down to the requisite thickness. In the Ellis plate, manufactured by Sir John Brown, of Sheffield, the face consists of a thin plate of rolled steel, which is welded to the wrought iron by molten steel, the combined plate being afterwards rolled as before. Hard steel is used, the proportion of carbon being from .65 to .80 %.

3. WROUGHT-IRON ARMOR.—This consists of either single or multiple rolled wrought-iron plates. When more than one plate is used, the degree of resistance is greatly influenced by the intervals between the plates.

4. CHILLED CAST-IRON PLATES.—These are cast in curved form, generally with double curved surfaces, and are principally manufactured by Grüson, of Buckau, near Magdeburg, Prussia. The exterior is chilled to a depth depending on the thickness of the plate, and a cross-section shows all varieties of cast iron, from the hardest and most brittle white variety on the exterior, to the softest and most ductile gray iron on the interior.

The value of any plate, whatever be the material, depends greatly upon the quality of the metal and the skill and care bestowed upon its manufacture. Large plates are proportionally more liable to defects than small ones, and the remarkable differences developed in the official trials are doubtless largely due to differences in manufacture.

EFFECT OF PROJECTILES UPON ARMOR PLATES.

The wrought-iron plate yields locally, being cleanly perforated when the striking energy is sufficient, or penetrated to a greater or less depth when the striking energy is insufficient for perforation. Beyond the shot-hole but little injury is done to the plate.

The compound plates, being harder, offer greater resistance, and are smashed or split open rather than punched. Both radiating and concentric cracks are formed around the point of impact, the latter being frequently very destructive. When the energy is not sufficient to destroy the plate, these cracks are limited to the steel face, which, in imperfectly welded plates, sometimes separates from the wrought iron in large pieces.

The steel plate also opposes great resistance, perhaps even more than the compound in some cases, though the face being softer, the projectile may penetrate a little deeper. The metal swells up around the point of impact, and radiating cracks are formed, which under continuous fire extend through the plate, breaking it in pieces. Concentric cracks are never observed.

Steel and compound plates are considered to offer a resistance to perforation approximately the same as a wrought-iron plate of 20 to 25 % greater thickness.

Chilled cast-iron plates oppose greater resistance to penetration than any other variety of armor, but this hardness is attained

at the expense of tenacity, and they are far more susceptible to racking effects than either the steel or compound armor. Up to the present time, no projectile has ever penetrated a Grüson chilled-iron plate to a greater depth than 2.8 inches.

Armor is classified as hard or soft according to its degree of resistance. Under the first head are included steel, compound, and chilled-iron armor, while wrought iron is the only form of soft armor.

The number of bolts required to hold the plates to the backing depends upon the kind of armor. While wrought iron only requires one bolt for about every ten or twelve square feet of surface, hard armor requires one bolt for every four square feet. So far it has not appeared that the bolt-holes weaken the plates appreciably, or determine the direction of the cracks. Cast-iron plates require no bolts; their shape makes them mutually supporting, like the stones of an arch or dome, and they are bonded by zinc solder.

With hard armor, a large plate has somewhat greater resistance proportionally than a small one, as the shock is distributed throughout the entire mass.

A recent method of measuring the force of blows upon hard armor is by the amount of energy per ton of plate. For penetration in soft armor the measure is the amount of energy per inch of circumference of the projectile.

USE OF ARMOR FOR SEA-COAST DEFENCES.

Grüson's chilled-iron armor has been used for coast defences by most of the continental European powers. It was originally adopted by France, but subsequently rejected.

In studying the recorded trials of Grüson's shields, we find the tests to which they have been subjected quite inferior to those which steel and compound plates have undergone. In no instance has a cast-iron plate been struck by a projectile having even 15,000 ft.-tons of energy, while steel and compound plates have been subjected to blows of 20,000, 34,000, and even 44,000 foot-tons. A casting may stand an indefinite number of light blows, yet be easily broken by a few heavy blows, and the total energy necessary to cause fracture will diminish rapidly with the number of blows into which it is divided. In 1873, a Grüson shield with a maximum thickness of thirty-three inches, withstood nineteen blows of 14,432 foot-tons each, or in all about 274,208

foot-tons. This was a remarkable result, but it may be asked how the plate would have fared had this energy been put into ten shots of 27,421 foot-tons each, or eight shots of 34,276 foot-tons each. It is true that land batteries must be assailed at longer ranges than will characterize purely naval engagements, but we must expect our armored defences to be frequently struck by projectiles having at least 34,000 foot-tons of energy, and to resist such a blow, according to Grüson's own formula, would require a maximum thickness of 47.7 inches of cast iron, while a 28-inch wrought-iron plate would suffice. Moreover, since turret guns on armored ships, and even broadside guns, are fired by electricity from the conning tower, it is far from improbable that a land turret should be struck by two of these heavy projectiles at the same instant, and in such a case, even though the points of impact may be well separated, the effect would undoubtedly be very disastrous to cast-iron armor.

In the fall of 1883, a Grüson turret plate with a maximum thickness of 43 inches, and a mean thickness of 35 inches, was subjected to 4 shots from Krupp's 12-inch rifle (30.5 c. m. 25 cal.). Each projectile weighed 981 pounds, and the striking energy in each case was 14,490 foot-tons, sufficient to penetrate about 20 inches of wrought iron. The fourth shot breached the shield, and rendered the gun chamber untenable. It is only fair to say that this result was partially attributed to the lack of firmness in the masonry bracing. A 43-inch plate should offer "thorough resistance" to a projectile with a striking energy of 22,000 foot-tons. Col. Inglis, R.E., says of this trial: "To help in forming an opinion as to whether this result may be fairly considered favorable or otherwise to cast-iron defence, it may be stated with confidence that for the cost of this cast-iron plate a shield affording equal cover could be made of good wrought-iron armor, which would stand four rounds similar to those fired at Buckau without being breached, and it is equally certain that if such a wrought-iron plate were to be subjected to further trial until ultimately pierced, the resulting injury would be of a much less serious character than that which was done to the cast-iron target. No doubt there is a great advantage on the side of the cast iron in the roundness of the form which may be given to it, which makes it very difficult to hit it at any but very oblique angles of incidence; but on the other hand there is the great disadvantage that a cast-iron structure cannot be afterwards strengthened by

applying additional thicknesses, as can be done with ease in the case of other kinds of armor."

The immense loss of energy due to the failure of the projectile to bite into this hard armor at oblique angles, lends great importance to the above-mentioned advantage. Moreover, no projectile has yet been found which gives entirely satisfactory results against chilled iron. The most perfect forged steel shots are shivered to atoms on impact, and it now seems probable that solid shot instead of shell will have to be used against such armor for battering purposes. No projectile can get through Grüson's plates without first shattering them to pieces.

There is another great advantage in the roundness of form, which has been strikingly exemplified in different trials. The planes of weakness are normal to the surface, and this being curved it follows that when the plate breaks, the pieces will have approximately the shape of frustums of pyramids, with the smaller bases on the interior. No piece can be driven in by any blow, however severe, so long as the other pieces retain their positions. In the trial of 1873 before referred to, the plate was broken in two at the fourth shot, and into several pieces by succeeding shots, yet the plate stood nineteen rounds and still afforded complete cover.

In consequence of the unexpected result of the trial of 1883, Grüson has recently modified the shape of his turrets by giving the front plates a greater slope or inclination to the horizontal, so that it is now practically impossible for a projectile having great energy, and hence a flat trajectory, to strike normal to the surface. The interior space is of course diminished by this turtle-back form.

Grüson's armor costs from $150 to $200 per ton for large-sized plates.

The heaviest cast-iron turret now in process of construction is that at the Helder in Holland. The armor weighs 580 tons, and the total load on the rollers will be 773 tons. The plates are 39 inches thick at the bottom, 43 inches at the level of the gun, and 10 inches where they join the top cover plate.

Steel and compound armor are principally used for naval purposes, and there are no existing fortifications armored with either class. In the severe competitive trials to which these plates have been subjected, each has scored complete victories, the results having been greatly influenced by the quality of the indi-

vidual plate, its mounting, backing, etc. From the recorded results, however, it would seem that under similar conditions they offer about equal resistances; that a projectile will get its point rather deeper into the steel than into the compound armor; that the racking effect is more severe on the compound plates; and that the result of complete perforation is far less destructive to the steel than to the compound armor.

In the Spezia trials of last October, Brown, Cammell, and Schneider plates, 18.89 inches in thickness, were perforated by 100-ton gun projectiles, with striking energies in each case of 44,340 foot-tons. One shot was fired at each target. The Brown plate was divided into four pieces and the steel face torn off all around the point of impact, showing some evident defect in manufacture; the Cammell plate was broken into six large pieces hanging by the bolts; while in the case of the steel armor "the projectile pierced the plate neatly, like a punch, forming a circular hole 580 m.m. (22.9 in.) in diameter." The plate was divided into three large pieces by radial cracks. As a result of this competition the Italian Government ordered steel plates for the armor of the *Lepanto*.

Krupp's hollow steel projectiles (forged and tempered) were used in each case. When loaded with sand they weighed 1,841 pounds, and undoubtedly possessed great tenacity and cohesion, but while the energy was sufficient to drive them through the plates, they were invariably broken into many pieces. The fragments were smaller in the case of the Cammell plate than in that of the steel plate, which the advocates of the former attributed to its greater resistance. There was no question, however, as to the fact that the Schneider plate had suffered far less than its rivals.

The impact of such heavy projectiles with such great energies invariably bends the plate more or less. The homogeneous steel adapts itself to this change of form far better than the compound armor, and the concentric cracks of the latter may be due to this cause. Even in the Shoeburyness experiments of 1883, the bending of the plate was noticeable, although the backing was solid granite, and the concentric cracks were deep and wide, and far more serious than those radiating from the point of impact. For this reason compound armor needs better backing than does armor of other kinds.

Neither steel nor compound plates can be readily manufactured with double-curved surfaces as can the cast-iron plates.

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Neither steel nor compound plates can be readily manufactured with double-curved surfaces as can the cast-iron plates.

Compound plates of the largest size weigh about fifty tons, the dimensions being 20′ x 10′ x 10″, or varying with the thickness, the weight remaining the same. The price ranges from $425 to $450 per ton. Schneider produces forty-ton plates at about $386 per ton.*

In the Spezia trials of 1882, Cammell, Brown, and Schneider plates, each 18.9 inches in thickness, were subjected to the fire of the 100-ton gun. The first round on each plate was with a striking energy of about 21,000 foot-tons, and the second round with an energy of about 34,000 foot-tons. Both compound plates were destroyed on the second round, and the steel plate succumbed on the fourth round. Referring to this trial, Col. Inglis says: "To give some idea of the merits and disadvantages of steel and compound armor as compared with wrought-iron plates, it may be mentioned that in the first three rounds [one shot at each target—E. G.] of the above trial, the projectile used would have pierced about 19 inches of ordinary rolled-iron armor, and in the remaining rounds about 25 inches of the same material. Further, a target composed of two thicknesses of wrought-iron plates, each 14 inches thick, would not only have offered complete protection against the gun used in this trial, but if it had been made of two such plates, and of the same length and breadth as the targets in the trials, it would have stood three rounds from the gun far better than either the Schneider steel or the Sheffield compound plates did, for the injuries would have been confined to the localities of the shot-marks, and would not have involved the general destruction of the target. In fact, the target would have been quite fit to receive, if not another round from the 100-ton gun, at any rate several rounds more from lighter natures of ordnance. Again, a target composed of two 14-inch wrought-iron plates would cost considerably less than one of a single compound plate 18.98 inches thick, the other dimensions being the same, and very far less than a target of steel armor of the same size. In this view, therefore, while for naval purposes, where the consideration of the saving of weight is one of paramount importance, the use of steel or steel-faced armor becomes almost a necessity; for fortifications on land, where increased weight has generally no disadvantage, there appears to be nothing in this experiment to warrant the adoption of either steel or compound

* These prices are taken from General Abbot's "Hasty Notes," and are those prevailing in the fall of 1883.

armor, except, perhaps, in certain special cases, such as in that of revolving turrets and cupolas, where there may be advantage in keeping down the weight of the total moving load."

Wrought iron has been exclusively used for sea-coast defences in England; for turrets, iron-fronted and shield batteries. Experience has shown that there is no appreciable loss in resistance by using two or three plates instead of putting all the metal in a single plate, while there is a considerable gain in economy. In the sandwich armor, the plates must not be separated by too great or too small intervals; five inches has been adopted as the proper distance whatever the other conditions may be. This distance is sufficient "to prevent the two pieces of metal from coming together, while at the same time it does not give room for the point of the shot to clear itself of the front plate before coming to the second plate." The present practice is to separate the plates by two layers of wood, each 2½ inches thick, one placed vertically and the other horizontally. There seems also to be a practical limit to the number of plates, and not more than three or, at the most, four separate plates can be used without appreciably diminishing the resistance over that of the equivalent single plate.

Oblique fire is much more effective on soft than on hard armor, as the point of the projectile encounters less resistance and bites more readily. In Krupp's experiments of 1882, a target composed of two wrought-iron plates with thicknesses of 7.9 inches and .98 inches, respectively, separated by 9.84 inches of wood, was penetrated at an angle of 35° with the normal, or 55° with the front of the target. The shot "went through the entire target and passed on up the range 328 yards uninjured."

The projectile was from the 5.9-inch rifle, and struck with a velocity of 1750 feet. Capt. Orde Browne, R.A., says: "It had sufficient work to have penetrated 9½ inches at the striking angle, supposing the projectile to 'bite' properly; but at so oblique an angle it has been found that the projectile has to be more than a match for the plate, generally speaking, to bite, and therefore the penetration was unusually good."

While, therefore, considerable advantage would be derived from the general curved shape of wrought-iron turrets, this advantage would not be nearly so great as in the case of cast-iron armor.

Wrought-iron plates cost from $220 to $330 per ton.

The heaviest wrought-iron turret in existence is that at Dover.

England. The total weight is about 1,000 tons, resting on thirty-six conical steel rollers.

PROJECTILES.

The resistance of armor varies greatly with the character of the projectiles used against it.

In 1882–3, experiments were conducted at Shoeburyness with 18-inch compound plates for the purpose of ascertaining the best kind of projectile for the attack of steel-faced armor. Col. Inglis gives the following as the results of this trial (1883).

"First, that forged steel shot, which have shown such marked superiority over every other kind of projectile in the attack of wrought-iron armor at all velocities, and which promised so well in shot up to the 9-inch calibre (weight 275 lbs.), against compound armor at moderate velocities, have failed to maintain that superiority in the case of heavier shot (12-inch calibre, and upwards of 700 lbs. weight), employed at higher velocities against very thick masses of compound armor. Next, that the cast-steel shot with chilled-iron head has shown itself to be scarcely, if at all, better than the service chilled cast-iron projectile for the attack of compound armor. The present trial further shows that little or no advance has been made of late in the manufacture of projectiles for the attack of hard armor. It has been found hitherto to be impossible to produce masses of steel of sufficient hardness to act upon steel and steel-faced armor without change of form, and at the same time to stand the effect of the shock on impact without breaking up. In fact, that which was done with projectiles of Whitworth steel against wrought-iron armor, when the same 9-inch shell was fired three times through 10 or 12 inches of wrought iron, has not been approached in the case of steel-faced armor. * * * In the existing state of things it is quite hopeless to expect that any kind of shell will be found to carry a bursting charge through a considerable thickness of steel or steel-faced armor."

In February, 1884, in a lecture before the Royal United Service Institution, Capt. Orde Browne said: "There is some reason to fear that our chilled projectiles are unsuitable ones to attack it (Grüson's chilled armor). In 1879, Krupp attacked a chilled shield made to represent Grüson's, with chilled shot. He wished it to be beaten by a wrought-iron shield of his own. In a few rounds he was disappointed at the effect of chilled shot and re-

placed them by steel ones, which, in a measure, broke the chilled iron.

"In 1882 I believe the French made some experiments against chilled-iron shields for inland fortifications. They had adopted them, but they found the effect of steel shot so much greater than that of chilled shot against chilled iron that they rejected this material for inland works. At Magdeburg the chilled-iron shield was broken by the blows of steel shot."

The London *Engineer*, Oct. 24, 1884, says: "The new forged steel projectiles, such as those of Krupp's make, possessing tenacity and great cohesion, require, in order to break them, an effort and space of time infinitely greater than that of cast-iron or brittle metal, so that the effort of penetrating or punching the material of the plates has time to develop itself before the pieces of the projectile become separated."

Whatever be their deficiencies, there seems to be no doubt about the superiority of the present forged-steel projectiles against *every* kind of armor, and their great cost is the only obstacle to their general adoption.

Steel shells are now made of great length to carry heavy bursting charges, and Capt. Browne mentions a "torpedo" shell only 8.27 inches in diameter, but which carries a bursting charge of 106 pounds. What effect would be produced by the explosion of such a shell when buried in a wrought-iron plate? I have found no record of such an experiment, but I doubt whether the result would be very serious to the plate. The hole caused by the penetrating shell would probably act like the bore of a mortar, and the main effect of the explosion would be outwards, enlarging the hole but little and developing but a slight tendency to increase the penetration. Should the time come, however, when nitro-gelatine shells can be fired with sufficient charges to give good penetration, and means can be found to prevent explosion upon impact, the effect will undoubtedly be disastrous.

Summing up these results, we are called upon to decide whether we shall use hard armor, which must be smashed to pieces, or soft armor, which cannot be smashed, and which may be made so thick that it cannot be perforated. Once before, we had the same problem presented, when our granite forts succumbed to the increased power of heavy ordnance. We solved it then by adopting earthen walls of far less resistance, and by

making them so thick that they could not be perforated we obtained secure cover. Shall we follow the same course now?

Grüson will make cast-iron turrets of any desired size and set them up in place for $200 per ton. We could not manufacture them ourselves, as the "trade secrets" of mixing the ores and controlling the chill are unknown to our iron-founders. Our chilled-iron work, however, is equal if not superior to any in the world in every other respect, and I believe that with proper inducements, our manufacturers would soon penetrate these secrets and rival Grüson in his own specialty. The objections to cast-iron turrets, however, are quite serious. In addition to those given, the turtle-back form now adopted will require much larger foundations, and in many localities this would entail considerable extra expense.

I would place steel before compound armor because of the greater cost of the latter as well as for other reasons. The price of steel armor is about double that of cast iron, but the greater thickness of the latter would make the ratio of cost of completed turrets much nearer unity.

The advantages of wrought iron have been set forth in some detail, and the choice seems to lie between this metal and low steel. The iron will probably be selected for casemated batteries, but for turrets the choice is not so evident, though at the present time, considering the difference in cost, I should say the advantage was with the iron. Soft steel has the requisite toughness together with superior resisting powers; and when the price of such steel approximates sufficiently to that of wrought iron the former will be used.

TABLE III.

FOREIGN ARMORED SHIPS AVAILABLE FOR OFFENSIVE OPERATIONS AGAINST THE UNITED STATES.

[Compiled chiefly from information furnished by the Office of Naval Intelligence, U. S. Navy Department.]

ABBREVIATIONS.

M. L. R. . .	Muzzle-loading rifle.	B. . .	Bulkhead.
B. L. R. . .	Breech-loading rifle.	S. . .	Steel armor.
S. B.	Smooth-bore.	C. . .	Compound armor.

The absence of any abbreviation indicates that the armor consists of wrought iron. The second column under "Thickness of Armor" includes *barbette towers*, *casemates*, and *citadels*, as well as TURRETS.

ENGLAND.

Name.	Date.	Displacement.	Draught.		Speed.	Class.	Thickness of Armor in Inches.		Armament.
							Side.	Turret.	
		Tons.	ft.	in.	Knots.				
Warrior	1860	9,210	27	0	14.8	Broadside.	4½		28 7-in., 6½-ton; 4 8-in., 9-ton M. L. R.
Black Prince . .	1861	9,210	27	0	13.6	"	4½		4 8-in., 9-ton; 24 7-in., 6½ ton M. L. R.
Defence	"	6,250	26	7	11.6	"	4½		2 8-in., 9-ton; 14 7-in., 6½ ton M. L. R.
Resistance . . .	"	6,250	26	8	11.6	"	4½		2 8-in., 14 7-in. M. L. R.
Hector	1862	6,710	26	0	12.3	"	4½		2 8-in., 16 7-in. M. L. R.
Minotaur	1863	10,690	27	0	14.4	"	5½		15 9-in., 12-ton M. L. R.; 2 6-in. B. L. R.
Achilles	"	9,820	27	4	14.3	"	4½		12 9-in., 12-ton; 2 7-in. M. L. R.; 2 6-in. B. L. R.
Wivern	"	2,750	17	0	10.6	2 Turrets.	4½	5	4 9-in. M. L. R.
Valiant	"	6,710	26	7	12.7	Broadside.	4½		2 8-in., 16 7-in. M. L. R.

ENGLAND [*Continued*].

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft.	in.	Knots.			
Scorpion	1863	2,750	17	0	10.5	2 Turrets.	4½	5	4 9-in. M. L. R.
Prince Albert	1864	3,880	20	4	11.7	4 "	4½	5½–10	4 9-in. M. L. R.
Lord Warden	1865	7,840	27	6	13.5	Broadside.	5½		2 9-in., 14 8-in., 2 7-in. M. L. R.
Agincourt	"	10,690	27	9	15.4	"	5½		1 9-in. M. L. R.; 2 6-in. B. L. R.
Bellerophon	"	7,550	26	0	14.2	"	6		11 8-in., 2 6-in. B. L. R.
Viper	"	1,230	11	7	9.6	"	4½		2 7-in. M. L. R.
Northumberland	1866	10,550	27	9	14.1	"	5½		5 9-in., 20 8-in. M. L. R.; 2 6-in. B. L. R.
Vixen	"	1,230	11	10	8.9	"	4½		2 7-in. M. L. R.
Penelope	1867	4,470	17	7	12.8	"	6		8 8-in. M. L. R.; 3 40-pdr. 35-cwt. B. L. R.
Hercules	1868	8,680	26	5	14.7	Central battery.	9		8 9.2-in., 18-ton; 6 6-in. B. L. R.
Monarch	"	8,320	26	7	14.9	2 Turrets and central battery.	7	8–10	4 12-in., 25-ton; 2 9-in., 12-ton; 1 7-in. M.L.R.
Repulse	1868	6,190	26	2	12.3	Broadside.	6		12 8-in. M. L. R.
Cerberus	"	3,340	15	2	9.7	2 Turrets.	8	10–9	4 10-in., 18-ton M. L. R.
Audacious	1869	6,010	23	3	13.6	Central battery.	8		10 9-in. M. L. R.; 8 4-in. B. L. R.
Invincible	"	6,010	23	0	14.0	" "	8		10 9-in. M. L. R.; 4 64-pdr. 71-cwt. B. L. R.
Magdala	"	3,340	15	2	10.6	2 Turrets.	8	10	4 10-in. M. L. R.
Iron Duke	1870	6,010	23	0	13.6	Central battery.	8		10 9-in. M. L. R.; 4 64-pdr. B. L. R.
Triumph	"	6,640	26	2	13.5	" "	8		10 9-in., M. L. R.; 4 5-in. B. L. R.
Swiftsure	"	6,040	26	1	13.8	" "	8		10 9-in. M. L. R.; 8 4-in. B. L. R.
Abyssinia	"	2,900	14	6	9.6	2 Turrets.	7	10	4 10-in., 18-ton M. L. R.
Sultan	"	9,290	27	6	14.0	Central battery.	9		8 9.2 in., 6 8-in. B. L. R.
Hotspur	"	4,010	21	8	12.7	1 Turret.	11	10–8½ C.	2 12-in. M. L. R.; 2 6-in. B. L. R.
Devastation	1871	9,330	27	1	13.8	2 Turrets.	12	14	4 12-in. M. L. R.
Glatton	"	4,910	19	3	12.1	1 Turret.	12	14	2 12 in. M. L. R.
Cyclops	"	3,480	16	4	10.0	2 Turrets.	8	10	4 10-in. M. L. R.
Hecate	"	3,480	16	4	10.9	2 "	8	10	4 10-in. M. L. R.
Hydra	"	3,480	16	4	11.2	2 "	8	10	4 10-in. M. L. R.

ENGLAND [*Continued*].

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft.	in.	Knots.			
Gorgon	1871	3,480	16	4	11.1	2 Turrets.	8	10	4 10-in. M. L. R.
Thunderer	1872	9,330	27	1	13.5	2 "	12	14	4 12½-in., 38-ton M. L. R.
Rupert	"	5,440	23	6	13.6	1 Turret.	12	14	2 9.2-in., 2 6-in, B. L. R.
Alexandra	1875	9,490	26	6	15.0	Central battery.	12		10 10-in., 2 11-in., 25-ton M. L. R.
Dreadnought	"	10,820	26	9	14.0	2 Turrets.	14	14	4 12½-in. M. L. R.
Shannon	"	5,390	23	0	12.5	Belted cruiser.	9		2 10-in., 7 9-in. M. L. R.
Temeraire	1876	8,540	27	2	14.7	2 Barbette towers and central battery.	11	10–8	4 11-in., 4 10-in. M. L. R.
Inflexible	1876	11,400	26	4	14.8	2 Turrets.	24	17–16C.	4 16-in., 80-ton M. L. R.
Nelson	"	7,620	25	9	14.0	Belted cruiser.	9	10½B.	4 10-in., 8 9-in. M. L. R.
Northampton	"	7,620	25	9	13.2	" "	9	10½B.	4 10-in., 8 9-in. M. L. R.
Superb	1875	9,100	26	5	13.2	Central battery.	12		16 10-in. M. L. R.
Neptune	1874	9,170	26	1	14.2	2 Turrets.	12	13–11	4 12½-in. M. L. R.; 2 8-in. B. L. R.
Orion	1879	4,830	21	4	12.8	Central battery.	12		4 12-in. M. L. R.
Belle Isle	1876	4,830	21	4	12.8	" "	12		4 12-in. M. L. R.
Agamemnon	1879	8,490	24	0	13.0	2 Turrets.	18	16–14C.	4 12½-in. M. L. R.; 2 6-in. B. L. R.
Ajax	1880	8,490	24	0	15.5	2 "	18	16–14C.	4 12½-in. M. L. R.; 2 6-in. B. L. R.
Conqueror	1881	6,200	24	0	13.0	1 Turret.	12 C.	12C.	2 12-in., 43-ton ; 4 6-in. B. L. R.
Collingwood	1882	9,150	26	3	16.8	2 Barbette towers.	18 C.	11½–10C.	4 12-in., 43-ton ; 6 6-in. B. L. R.
Edinburgh	"	9,150	26	3	17.2	2 " "	18 C.	16C.	4 12-in., 43-ton ; 5 6-in. B. L. R.
Colossus	"	9,150	26	3	16.5	2 " "	18 C.	16C.	4 12-in., 43-ton ; 5 6-in. B. L. R.
Imperieuse	1883	7,390	25	5	16.0	4 " "	10 C.	8C.	4 9.2-in. 6 6-in. B. L. R.
Warspite *	1884	7,390	25	5	16.0	4 " "	10 C.	8C.	4 9.2-in. 6 6-in. B. L. R.
Howe *	1885	9,600	27	3	16.0	2 " "	18 C.	11½–10C.	4 13½-in., 63-ton ; 6 6-in. B. L. R.
Anson *		10,000	27	3	16.0	2 " "	18 C.	14–12C.	4 13½-in., 63-ton ; 6 6-in. B. L. R.
Rodney *	1884	9,600	27	3	16.0	2 " "	18 C.	11½–10C.	4 13½-in., 63-ton ; 6 6-in. B. L. R.
Camperdown *		10,000	27	3	16.0	2 " "	18 C.	14–12C.	4 13½-in., 63-ton ; 6 6-in. B. L. R.
Benbow *		10,000	27	3	16.0	2 " "	18 C.	14–12C.	2 16½-in., 110-ton ; 10 6-in. B. L. R.

* Not completed.

ENGLAND [*Continued*].

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Renown *. . . .		10,470	27 3	15.5	Turret.	18 C.	18 C.	2 110-ton, 1 9.2-in., 12 6-in. B. L. R.
Sanspareil * . . .		10,470	27 3	15.5	"	18 C.	18 C.	2 110-ton, 1 9.2-in., 12 6-in. B. L. R.
Orlando *. . . .		5,000	22 6	17.5	Belted cruiser.	10 C.		2 9.2-in., 10 6-in. B. L. R.
Undaunted *. . .		5,000	22 6	17.5	" "	10 C.		2 9.2-in., 10 6-in. B. L. R.
Australia * . . .		5,000	22 6	17.5	" "	10 C.		2 9.2-in., 10 6-in. B. L. R.
Narcissus * . . .		5,000	22 6	17.5	" "	10 C.		2 9.2-in., 10 6-in. B. L. R.
Galatea * . . .		5,000	22 6	17.5	" "	10 C.		2 9.2-in., 10 6-in. B. L. R.

* Building.

FRANCE.

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament. All breech-loading rifles (B. L. R.).
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Couronne . . .	1861	6,428	28 6	12.7	Broadside.	5.6		8 9½-in., 4 7½-in.
Heroine	1863	6,007	27 5	13.0	"	5.6		8 9½-in., 3 7½-in., 2 5½-in.
Provence	"	5,815	27 4	13.9	"	5.9		8 9½-in., 3 7½-in., 2 5½-in.
Flandre	1864	5,964	27 7	14.3	"	5.9		8 9½-in., 5 7½-in.
Savoie.	"	5,896	28 0	13.5	"	5.9		8 9½-in., 3 7½-in., 4 5½-in.
Surveillante . . .	"	6,220	28 10	13.2	"	5.9		8 9½-in., 4 7½-in., 4 5½-in.
Valeureuse . . .	"	5,984	28 0	13.8	"	5.9		8 9½-in., 1 7½-in., 4 6⅝-in.
Revanche . . .	"	5,790	27 2	13.3	"	5.9		8 9½-in., 3 7½-in., 2 5.5-in.
Belliqueuse . . .	1865	3,447	21 10	11.8	"	5.9	4½	4 7½-in., 4 6⅝-in., 4 5½-in.

FRANCE [*Continued*].

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament. All breech-loading rifles (B. L. R.).
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Alma	1867	3,788	24 0	11.9	2 Barbette towers and central battery.	5⅞	4¾	6 7½-in.
Ocean	1868	7,749	29 10	13.7	4 Barbette towers and central battery.	7⅞	5⅞	4 10⅝-in., 4 9½-in., 2 5½-in.
Montcalm	1868	3,889	23 8	11.7	2 Barbette towers and central battery.	5⅞	4¾	6 7½-in.
Atalante	1868	3,825	23 3	11.8	2 Barbette towers and central battery.	5⅞	4¾	6 7½-in.
Reine Blanche	1868	3,845	23 9	11.8	2 Barbette towers and central battery.	5⅞	4¾	6 7½-in.
Marengo	1869	7,172	27 9	13.5	4 Barbette towers and central battery.	7⅞	5⅞	4 10⅝-in., 4 9½-in., 7 5½-in.
Suffren	1870	7,604	29 10	14.3	4 Barbette towers and central battery.	7⅞	5⅞	4 10⅝-in., 4 9½-in., 6 6½-in.
Gallissoniere	1872	4,487	23 10	13.1	2 Barbette towers and central battery.	5⅞	4¾	6 9½-in., 6 3⅝-in.
Friedland	1873	8,916	29 11	13.3	Central battery.	7⅞		8 10⅝-in., 8 5½-in.
Richelieu	"	8,790	27 10	13.1	4 Barbette towers.	8⅝	6.3	6 10⅝-in., 5 9½-in., 7 5½-in.
Colbert	1875	8,617	28 6	14.5	Central battery.	8⅞	6⅝	8 10⅝-in., 2 9½-in., 6 5½-in.
Victorieuse	"	4,576	22 8	12.8	2 Barbette towers and central battery.	5⅞	4¾	6 9½-in., 1 7½-in., 6 5½-in.
Tonnerre	1875	5,584	21 4	14.0	1 Turret.	14¼	13¼	2 10⅝-in.
Redoubtable	1876	8,854	24 10	14.7	Central battery.	14	9.5	8 10⅝-in., 6 5½-in.
Trident	"	8,814	29 1	14.2	2 Barbette towers and central battery.	8⅝	6⅝	8 10⅝-in., 2 9½-in., 6 5½-in.
Tempête	1876	4,523	16 9	12.8	1 Turret.	13	11⅝	2 10⅝-in.
Triomphante	1877	4,127	22 8	12.9	2 Barbette towers and central battery.	5⅞	4¾	6 9½-in., 1 7½-in., 6 5½-in.

FRANCE [*Continued*].

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament. All breech-loading rifles (B. L. R.).
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Fulminante	1877	5,584	21 4	13.2	1 Turret.	14½	13½	2 10⅝-in.
Thétis	1867	3,621	21 10	12.0	2 Barbette towers and central battery.	5⅛	4¾	6 7.5-in., 4 3⅝-in.
Vengeur	1878	4,523	16 9	13.8	1 Turret.	13	13¾	2 13½-in.
Ad. Duperré	1879	10,486	26 0	14.5	4 Barbette towers.	21.6	12	4 13.5-in., 14 5.5-in.
Devastation	"	9,639	24 11	15.2	Central battery.	15		4 13.5-in., 4 10⅝-in., 6 5.5-in.
Turenne	"	5,881	24 10	14.0	4 Barbette towers.	9⅞	7⅞	4 9.5-in., 2 7.5-in., 6 5.5-in.
Bayard	1880	5,881	24 10	14.5	4 " "	9⅞	7⅞	4 9.5-in., 2 7.5-in., 6 5.5-in.
Tonnant	"	4,523	16 9	12.8	1 Turret.	17¾	14⅝	2 13.5-in.
Requin	1881	7,184	24 9	14.5	1 "	20⅛ S.	19 S.	2 16½-in., 4 4-in.
Terrible	"	7,184	24 9	14.5	1 "	20½ C.	19 C.	2 16½-in., 4 4-in.
Vauban	1882	5,869	24 10	14.0	4 Barbette towers.	9⅞	8	4 9.5-in., 1 7.5-in.
Foudroyant	"	9,639	24 11	14.2	Central battery.	15		4 13.5-in., 4 10-in., 6 5.5-in.
Duguesclin *	1883	5,869	24 10	14.0	4 Barbette towers.	9⅞	8	4 9.5-in., 1 7.5-in , 6 5.5-in.
Formidable *	1885	11,441	26 0	16.0	3 " "	21⅛ S.	15½	3 16.5-in., 12 5.5-in.
Caiman *	"	7,239	24 9	14.5	1 Turret.	20⅛ C.	17½ S.	2 16.5-in., 4 4-in.
Furieux *	1883	5,695	21 4	13.0	1 "	19.6	17½ S.	2 13.5-in.
Ad. Baudin *	"	11,441	26 0	16.0	3 Barbette towers.	21⅝ S.	16½	3 16.5-in., 12 5.5-in.
Indomitable *	"	7,184	24 9	14.5	1 Turret.	20⅛ C.	19 C.	2 16.5-in., 4 4-in.
Hoche *	1885	9,864	27 2	16.0	4 Barbette towers.	17½ C.	15⅝	2 13.5-in., 2 10⅝-in., 20 5.5-in
Marceau *	1884	9,864	27 2	16.0	4 " "	17½ C.	15⅝	2 13.5-in., 2 10⅝-in., 20 5.5-in.
Neptune *	1885	9,861	27 0	16.0	4 " "	17½ C.	15¾	3 15.5-in., 18 5.5-in.
Magenta *	"	9,864	27 2	16.0	4 " "	17½ C.	15¾	2 13.5-in., 2 10⅝-in., 18 5.5-in.
Charles Martel *	"	9,780	28 0	15.0?	4 " "	17½ S.		4 13½-in., 8 5 5-in.
Brennus *	"	9,780	28 0	15 0?	4 " "	17¾ S.		4 13½-in., 8 5.5-in.

* Not completed.

GERMANY.

Name.	Date.	Displacement.	Draught.	Speed.	Class	Thickness of Armor in Inches.		Armament. All breech-loading rifles (B. L. R.).
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Arminius	1864	1,583	12 5	10.5	2 Turrets.	4½	7½	4 8½-in.
Friedrich Carl	1867	6,007	24 0	13.6	Central battery.	5		16 8½-in.
Kronprinz	"	5,568	24 3	14.3	" "	5		16 8½-in.
Konig Wilhelm	1868	9,757	26 6	14.7	" "	8		18 9½-in., 5 8½-in.
Hansa	1872	3,610	21 7	12.0	" "	6½		8 8½-in.
Preussen	1873	6,770	24 9	14.0	2 Turrets.	9½	8½	4 10½-in., 2 6.7-in.
Friedrich du Grosse	1874	6,770	24 9	14.0	2 "	9½	8½	4 10½-in., 2 6.7-in.
Kaiser	"	7,676	26 0	14.6	Central battery.	10	8	8 10½-in., 1 8½-in.
Deutschland	"	7,676	26 0	14.5	" "	10	8	8 10½-in., 1 8½-in.
Sachsen	1877	7,400	19 8	14.0	Central battery and 1 barbette tower.	17½	10	6 10½-in. (2-in T. and 4-in C.).
Bayern	1878	7,400	19 8	14.0	Central battery and 1 barbette tower.	17½	10	6 10½-in. (2-in T. and 4-in C.).
Würtimberg	1878	7,400	19 8	14.0	Central battery and 1 barbette tower.	17½	10	6 10½-in. (2-in T. and 4-in C.).
Baden	1880	7,400	19 8	14.0	Central battery and 1 barbette tower.	17½	10	6 10½-in. (2-in T. and 4-in C.).
Oldenburg	1884	5,200	19 6	14.0	Central battery.	12.8		8 9.36-in., 4 5.85-in.

Name.	Date.	Displacement.	Draught.		Speed.	Class.	Thickness of Armor in Inches.		Armament. All breech-loading rifles (B. L. R.).
							Side.	Turret.	
		Tons.	ft.	in.	Knots.				
Prevenetz . . .	1864	3,277	15	0	9.0	Broadside.	4½		14 8-in.
Sevastopol . . .	1862	6,209	26	4	14.0	"	4½		16 8-in., 1 6-in.
Netzonmeña . .	1864	3,840	17	0	8.0	"	5½		14 8-in.
Kreml.	"	3,812	18	0	8.5	Central battery.	6		14 8-in.
Petropavloski . .	1865	6,175	26	0	11.0	Broadside.	4½		21 8-in., 1 6-in.
Knaz Pojarskoi. .	1867	4,509	22	0	10.0	Central battery.	4½		8 8-in., 2 6-in,
Ad. Lazereff . .	"	3,753	20	0	10.0	3 Turrets, monitor.	4½	6	6 9-in.
Ad. Greigh . . .	1868	3,841	21	0	10.0	3 " "	4½	6	3 11-in.
Ad. Cicagoff. . .	"	3,692	18	6	10.7	2 " "	6	6	2 11-in.
Ad. Spiridoff . .	"	3,744	18	6	10 7	2 " "	6	6	2 11-in.
Peter the Great .	1872	9,665	24	9	13 0	2 "	14	14	4 12-in,
General Admiral .	1873	4,603	23	0	14.0	Belted cruiser.	6		4 8-in., 2 6-in.
Duke of Edinburgh	1875	4,602	23	0	14 0	" "	7		10 6-in.
Novgorod . . .	1873	2,505	13	2	7.0	Popoffka, 1 barbette tower.	11	11	2 11-in.
Ad. Popoff . . .	1875	3,590	13	5	8.3	" " "	18	18	2 12-in.
Minin	1878	5,740	25	7	12.5	4 Barbette towers.	8		4 8-in., 8 6-in., 4 4-in.
Vladimir Monomach	1882	5,754	25	0	17.0	4 " "	6 C.	12	4 8-in., 12 6-in., 4 4-in.
Dimitri Douskoi .	1883	5,893	25	0	16.0	4 " "	6 C.	12	2 8-in., 14 6-in., 16 4- and 3-in.
Tchesmé * . . .	"	10,181	25	(m.)	16 0	3 " "	15–10	12	6 12-in., 7 6-in,
Sinope *	"	10,181	"		16.0	3 " "	15–10	12	6 12-in., 7 6-in.
Catherine the Great*	"	10,150	"		(?)	3 " "	18	14	6 12-in., 7 6-in.
Ad. Naphimoff * .		7,781	25	9	16.0	Belted cruiser, 4 barbette towers.	8	14	4 9-in., 10 6-in.
Moskwa * . . .									
Alexander the II.*		7,712	25	9	16 0	Belted cruiser, 4 barbette towers.	6	14	4 9-in., 10 6-in.

* Not completed,

ITALY.

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft. in.	Knots				
Terrible	1861	2,700	17 9	10.0	Broadside.	4½		8 7½-in. M. L. R.
Formidabile	"	2,700	17 9	10.0	"	4½		8 7½-in. M. L. R.
Castelfidardo	1863	4,250	22 0	12.0	Central battery.	4⅝		2 9-in., 12½-ton ; 9 8-in., 9-ton M. L. R.
Maria Pia	"	4,250	22 0	11½	" "	4.7		2 9-in., 9 8-in. M. L. R.
San Martino	"	4,250	22 0	11½	" "	4.7		2 9-in., 9 8-in. M. L. R.
Ancona	1864	4,250	22 0	13.0	" "	4.7		2 9-in., 9 8-in. M. L. R.
Roma	1865	5,800	25 3	13.0	" "	4⅝		11 10-in. M. L. R.
Affondatore	"	4,370	21 6	13.0	2 Turrets.	5	5½	2 10-in. B. L. R.
Varese	"	2,000	15 9	9.0	Central battery.	4⅝		4 7½-in. M. L. R.
Palestro	1871	6,161	26 10	12.9	" "	8⅝		1 11-in., 6 10-in. M. L. R.
Principe Amedeo	1872	5,854	26 2	12.4	" "	8⅝		1 11-in., 6 10-in. M. L. R.
Duilio	1876	11,570	28 7	15.0	2 Turrets.	21.7 S.	17.7	4 17.72-in., 100-ton ; 4 4.7-in. M. L. R.
Dandolo	1878	11,434	28 7	15.5	2 "	21.7 S.	17.7	4 17.72-in., 4 4.7-in. M. L. R.
Italia	1880	13,851	30 3	16.0	2 Turrets and oval central battery.		18.9C. †	4 17-in., 100-ton.; 9 6-in. B. L. R.
Lepanto *	1883	13,551	30 3	16.0	2 Turrets and oval central battery.		18.9 S. †	4 17-in., 9 6-in. B. L. R.
Ruggiero-di-Lauria*	1884	10,045	25 11	17.0	1 Barbette turret.	17.72S		4 103-ton, 12 6-in. B. L. R.
Francesco Morosini*	1881	10,045	25 11	"	" "	17.72S		4 103-ton, 12 6-in. B. L. R.
Andrea Doria *	1882	10,045	25 11	16.0	" "	17.72S		4 103-ton, 12 6-in. B. L. R.
Re Umberto *	1885	13,251		16.0				

* Not completed. † Citadel.

MERCANTILE LIBRARY NEW YORK

TURKEY.

Name.	Date.	Displacement.	Draught.		Speed.	Class.	Thickness of Armor in Inches.		Armament.
							Side.	Turret.	
		Tons.	ft.	in.	Knots.				
Azizyeh	1864	6,400	27	0	12.0	Broadside.	5½		14 8-in. Arm. 1 9.5 Krupp, 2 6-in. Krupp.
Mahmondiyeh . .	"	6,400	27	0	12.0	"	5½		14 8-in. Arm. 1 9.5 Krupp, 2 6-in. Krupp.
Osmanyeh . . .	"	6,400	27	0	12.0	"	5½		14 8-in. Arm. 1 9.5 Krupp, 2 6-in. Krupp.
Orkaniyeh . . .	1865	6,400	27	0	12.0	"	5½		14 8-in. Arm. 1 9.5 Krupp, 2 6-in. Krupp.
Assar-i-Tirfix . .	1868	5,687	21	0	13.0	2 Barbette towers and central battery.	6	8	8 9-in. M. L. R.
Avni Illah . . .	1869	2,380	16	6	12.5	Central battery.	6		4 9-in. M. L. R.
Mooyini Zaffar . .	1868	2,380	16	6	12.5	" "	6		4 9-in. M. L. R.
Nidj-un-Shefket .	1869	2,046	16	6	11.0	1 Barbette tower and central battery.	6	4½	1 9-in., 4 7-in. M. L. R.
Hufzi Rhaman . .	1868	2,500	19	5	12.0	2 Turrets.	4½	5	2 9-in., 2 7-in. M. L. R.
Assar-i-Shefket . .	1869	2,046	16	6	11.0	1 Barbette tower and central battery.	5½		1 9-in., 4 7-in. M. L. R.
Feth-i-Bulend . .	1869	2,760	18	0	12.5	Central battery.	9		4 9-in. M. L. R.
Idjlaliyeh . . .	1870	2,228	17	6	11.0	1 Barbette tower and central battery.	6	4½	2 9-in., 2 7-in. M. L. R.
Mookademi Khair .	1872	2,760	18	0	12.0	Central battery.	9		4 9-in. M. L. R.
Mesoodiyeh . . .	1874	8,950	26	5	13.1	" "	12		12 10-in., 2 7-in. M. L. R.
Hamidiyeh . . .	1878	7,920	25	6	13.0	" "	10		10 9-in., 2 7-in. B. L. R. (Krupp).

AUSTRIA.

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft.	in.	Knots.			
Salamander * . .	1861	3,040	20	10	11.4	Broadside.		4½		10 7-in. M. L. R. 6 light guns.
Ferdinand Max. .	1865	5,170	25	7	10.0	"		5		14 7-in. M. L. R. 6 light guns.
Hapsburg . . .	"	5.170	25	7	10,0	"		5		14 7-in. M. L. R. 6 light guns.
Lissa	1869	6,030	28	6	13.3	Central battery.		6½		12 9½-in. M. L. R. 6 light guns.
Custoza	1872	7,090	26	9	14.0	"	"	9		8 10½-in. B. L. R. 8 light guns.
Erzherzog Albrecht	"	6,020	25	4	13.4	"	"	8		8 9½-in. B. L. R. 8 light guns.
Kaiser	"	5.840	26	0	12.7	"	"	6½		10 9 in. M. L. R. 8 light guns.
Don Juan D'Austria	1875	3,540	20	9	12.7	"	"	8		8 8½-in. B. L. R. 6 light guns.
Kaiser Max . . .	"	3.540	20	9	12.7	"	"	8		8 8½-in. B. L. R. 6 light guns.
Prinz. Eugen . .	1877	3,570	20	9	12.7	"	"	8		8 8½-in. B. L. R. 6 light guns.
Tegethoof . . .	1878	7,450	26	7	14.0	"	"	14½		6 11-in. B. L. R. 8 light guns.
Erzherzog Rudolf †	1884	6,900	25	0		1 Turret.		12S.		2 12-in., 6 3½ in. B. L. R.
—— †		6,900	25	0		"		12S.		2 12-in., 6 3½ in. B. L. R.

* Rebuilding † Not completed.

DENMARK.

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Denmark	1864	4,747	19 0	8.1	Broadside.	4½		12 8-in. M. L. R., 12 6-in. S. B.
Peder Skram . .	"	3,373	20 0	11.7	"	4½		8 8-in. M. L. R., 8 6-in. S. B.
Lindormen . . .	1868	2,076	15 9	12.0	2 Turrets.	5	5	2 9-in. M. L. R.
Gorm	1870	2,344	14 0	12 2	1 Turret.	7	8	2 10-in. M. L. R.
Odin	1872	3,083	15 1	12.4	1 Turret and central battery.	8	8	4 10-in. M. L. R.
Helgoland . . .	1878	5,347	18 0	13.5	" " "	12	10	1 12-in., 4 10½-in., 5 5-in. B. L. R.
Iver Hvitfeldt * .		3,260						

* Not completed.

HOLLAND.

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Prince Henry of the Netherlands . .	1865	3,375	18 9	12.0	Central battery and 2 turrets.	4½	5.5	4 9-in., 4 4.7-in. M. L. R.
Schorpionen . . .	1868	2,275	15 10	12.8	1 Turret.	6	8	2 9-in. M. L. R.
Stier	"	2,069	15 7	12.3	"	6	8	2 9-in. M. L. R.
Buffel	"	2,198	15 6	12.7	"	6	8	2 9-in. M. L. R. 4 30-pdrs. S. B.
Guinea	1870	2,378	15 9	12.0	"	6	8	2 9-in. M. L. R.
King of the Netherlands.	1874	5,400	19 0	12.0	2 Turrets.	8	12	4 11-in., 4 5-in. M. L. R.
Matador	1878	1,650	9 11	7.0	1 Turret.	4½	9	2 11-in. M. L. R.

SPAIN.

Name.	Date.	Displacement.	Draught.		Speed.	Class.	Thickness of Armor in Inches.		Armament.
							Side.	Turret.	
		Tons.	ft.	in.	Knots.				
Numancia . . .	1863	7,300	26	7	8.0	Broadside.	5½		8 9-in., 7 8-in., 8 small calibre M. L. R.
Vitoria	1865	7,200	27	4	11.5	"	5½		8 9-in., 3 8-in., 6 small calibre M. L. R.
Zaragoza	1867	5,400	24	10	8.0	"	5		4 9-in., 3 7-in., 10 6½ in., M. L. R.
Sagunto	1869	7,300	25	11	8.0	Central battery.	6		8 9-in., 3 7-in. M. L. R.
Mendez Nuñez . .	1861	3,350	22	0	6.5	" "	4½		4 9-in., 2 8-in. M. L. R.

One armored vessel building.

BRAZIL.

Name.	Date.	Displacement.	Draught.		Speed.	Class.	Thickness of Armor in Inches.		Armament.
							Side.	Turret.	
		Tons.	ft.	in.	Knots.				
Ad. Barroso . . .	1864	1,354	8	10	9.0	Central battery.	3⅞		2 7-in., 3 32-pdrs. M. L. R.; 2 68-pdrs. S. B.
Solimoës	1876	3,700	11	6	12.0	2 Turrets.	12	11–13	4 10-in. M. L. R.
Javary	"	3,700	11	6	12.0	"	12	11–13	4 10-in. M. L. R.
Sete-de-Setembro .	1874	2,145	12	6	11.0	Broadside.	4½		4 9¼-in. M. L. R.
Riachuelo . . .	1883	5,791	20	0	16.0	2 Barbette towers.	11C.	11	4 9.2-in., 20-ton; 6 ——, 5½-ton B. L. R.
Aquidaban* . .	1885	5,791	18	0	15.5	2 Turrets.	11C.	10	4 9.2-in., 20-ton; 4 ——, 5½-ton B. L. R.

* Not completed.

JAPAN.

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side	Turret.	
		Tons.	ft. in.	Knots.				
Foo-So	1877	3,718	18 3	14.0	Central battery.	9		4 9½-in., 2 6½-in. B. L. R.
Kongo	"	2,200	17 6	14.0	Belted cruiser.	4½		6 6-in., 3 6½-in. B. L. R.
Ki Yei	"	2,200	17 6	14.0	" "	4½		6 6-in., 3 6½-in. B. L. R.

The Tsukushi having only a protected deck is not included.

CHILI.

Name.	Date.	Displacement.	Draught.	Speed.	Class.	Thickness of Armor in Inches.		Armament.
						Side.	Turret.	
		Tons.	ft. in.	Knots.				
Huascar	1866	2,032	15 6	11.0	1 Turret.	4½	5½	2 8-in. B. L. R.; 4 20-pdrs.
Almirante Cochrane	1874	3,500	19 8	12.8	Central battery.	9		6 8-in. B. L. R.
Blanco Encalada .	1875	3,500	19 8	12.8	" "	9		6 9-in. M. L. R.

The Esmeralda, having only a protected deck, is not included.

ERRATA.

Page 407, line 34, for *seven-eighths* read *five-eighths.*

Page 415, line 26, for 1873 read 1773.

Page 432, footnote, for *twenty-two* read *nine.* [See armaments of modern French and Italian ships, Table III.]

Page 435, line 29, omit 12-*inch.*

Page 439, line 20, for *Trogg's* read *Throgg's.*

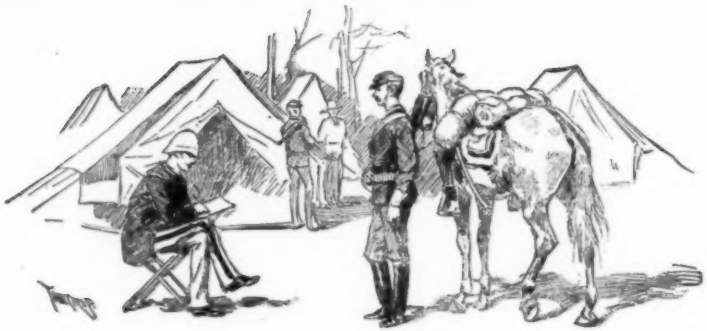
Page 456, Table III., for *Indomitable* read *Indomptable.*

Page 456, Table III., each of the French ships *Requin, Terrible, Caiman,* and *Indomptable,* mount guns in *two* (2) barbette towers.

Page 459, Table III., Displacement of the *Andrea Doria,* for 10,045 read 13,851.

Page 459, Table III., *The Lauria, Morosini,* and *Doria,* each mount guns in *two* (2) turrets.

NOTE.—The foregoing paper on "Our Sea-Coast Defences" was read by its author before the MILITARY SERVICE INSTITUTION during the year 1885. It was then published in "Monograph" form, and is reprinted here from the original plates. Lieut. Griffin has since been promoted to the rank of Captain in the Corps of Engineers.—[EDITOR.]



· CORRESPONDENCE ·

NOTES ON THE CANADIAN MILITIA.

By a Foreign Correspondent of Council.

KINGSTON, CANADA, *Sept.* 16, 1886.

For the last two months the militia of Canada has been ardently engaged in competition for money prizes, for skill in rifle-shooting. Every province has its rifle association. Every association has its annual meeting. As a grand climax to the whole comes the meeting of the Dominion Rifle Association at Ottawa, with its score of matches for cups and prizes. As many as 850 odd prizes, of an aggregate value of over $6,000, have this year been competed for. A number of the best marksmen produced at this meeting are selected for the team which pays a visit each year to Wimbledon, England. The last Wimbledon team has just returned from the old country, having scored as many successes as usual.

Looking at the number of competitors at these gatherings, the time consumed in the competitions, the large amount of money expended, and bearing in mind the fact that *individual* accurate shooting is of comparatively little value in war, it is hard to suppress the thought that so much energy might be far more beneficially employed if extended in the direction of rendering the officers and men of the militia better soldiers as a body.

The artillery spend their energies in much the same manner as the infantry. Prizes are offered by the Dominion and other artillery associations for target practice and competitions in "shifting ordnance." The latter operation consists in dismounting a gun from its carriage and replacing it in a certain limited time, and may be looked upon as a relic of ancient days. A team of gunners is likewise sent home each year to compete at Shoeburyness, England, with their British fellows. Beyond the fact that both the members of the Wimbledon and Shoeburyness teams get a cheap trip to the old country at the expense of their respective associations, it is difficult to see what benefit is derived from the custom in a military point of view. As a matter of policy, and as in some way tending to strengthen the maternal ties, it may be advisable and expedient.

Certain battalions, batteries, and troops of cavalry have been assembled in camps during the summer for the annual training of twelve days. These camps have been, in some cases, inspected by the general commanding the militia. The reports have not yet been issued.

A force of three battalions and two companies of infantry, two batteries of artil-

lery, and a regiment of cavalry has been assembled here in camp since the 7th inst. The weather has been unusually unfavorable, and the tents have had a soaking nearly every night. Out of the twelve days allowed for training one must be deducted for marching in, one for marching out, and one Sunday, leaving nine days for actual work. Of these nine days one is occupied in marching round the town, and another in a popular performance known as a "sham fight," whilst a third is devoted to inspection. The number of days available for useful work may therefore be put down at six, and a part of these six days is allowed for firing at the butts. The amount of drill that each man gets is very limited in consequence. It may be remarked that, out of the 1,100 odd men assembled here, about two thirds are recruits, and perhaps have never previously handled a rifle. Again, take into consideration the fact that a large part of the training consists in mounting guard, and an idea of the efficiency of the force may be imagined. It can hardly be contended that the instruction of a man for five or six days fits him for the exigencies of war, and it is not to be wondered at that the major-general spoke strongly in the report last year of the advisability of a longer annual training, even if it should necessitate the reduction of several rural battalions on the score of public expense. A walk round the camp and a few words of instruction to the men will reveal at once how anxious these latter are to learn, and how readily they accept hints with regard to their military duties. A talk with the officers reveals the weak point exactly where there should be a strong one. The company officers, upon whom almost every thing depends, in modern warfare, if weighed in the balance, would almost invariably be found wanting. The "sham fight" of to-day, introducing the spectacle of infantry advancing to the attack of a fort, utterly regardless of cover; and pushing forward over a bare fire-swept glacis up to the very edge of the ditch; standing there for some minutes blazing away without a sign of fire discipline or control, whilst a battery accompanied the firing line, and in the space of eight hundred yards came into action and limbered up five times in full view of the enemy;—such a sight would provoke laughter were it not for the more serious thoughts suggested of the disastrous results which might follow such teaching.

It is pleasant to turn from this to a camp held in New Brunswick, where some really good work was done by a company of engineers, one of the three companies of which the country may be proud. But again competition comes into view, this time for a "challenge shield," awarded for the best piece of work done in the year. The inspector of engineers was present to make the award. The piece of work for this year's competition is a bridge. Major Vince, commanding the Brighton Engineers at the camp in question, sends me the following details of his work:

"The bed of the stream was 107 feet wide from bank to bank. At this time of year the water is shallow, and only a part of the bed covered with it.

"On the day previous to the construction a section of the stream had been taken, and the lumber necessary for the construction cut by the men and hauled on wagons to one bank near the place of construction.

"The party consisted of six non-commissioned officers and twenty-six sappers. The bridge consisted of eight trestles, with span of about twelve feet. These eight trestles were built by four parties, each party consisting of one sergeant and four sappers, a memorandum being given to each sergeant as to the dimensions of his trestles. One party of one N.-C. O. and four sappers prepared road bearers, and another party of one N.-C. O. and four sappers prepared the covering, which consisted of tamarac poles of from two-inch to four-inch diameter. The remaining two sappers prepared treenails.

"We were somewhat short of saws and augers, so that there was only one set (such as it was) to two parties.

"The first trestle was a four-legged one, made with only *one* transom (8" diameter). The other trestles were single. The transoms were laid on top of the standards, and were beaten off a little with an axe so as to bear easily.

"The transoms were pinned to the standards, as also were the legers and diagonals, and the diagonals were pinned together where they crossed, so that each single trestle had nine pins or treenails:

"2 2-inch pins through transom.
2 1½-inch " " leger.
4 1½-inch " " diagonals.
1 1-inch " " diagonals.

"After the trestles were got in position the outside road bearers were pinned to the transoms, and the inner ones were *carefully* prepared and layed so that they did not in any way cause the floor to be *uneven*. The covering, which was sawn in ten-feet lengths, was laid on and fastened down by ribands which were held in their places by wooden pins. The hand-rail was made and fastened by the use of saw, axe, and auger only."

The time allowed for construction is six hours. This bridge was fit for the passage of troops within four and a half hours, and was complete in every particular, including notice board. This original piece of work seems to deserve high praise. The New Brunswicker is an adept with the axe; it is to him what the "khookrie" is to the Goorkha, and the "dah" to the Burman.

Two events which concern the empire in general, and Canada in particular, deserve notice.

Col. O'Brien, of the Royal Engineers, is paying a visit to British Columbia, to report upon the fortifying of a harbor and coaling station on the Pacific coast. The selection of a strategic point on this coast has long been matter of talk; it is brought more nearly home to us by the opening of the Canadian Pacific Railway. The Canadian government has voted £20,000 for fortification of Esquimault, and the Imperial government £30,000 for guns and torpedoes.

A commission has been sent from England to buy horses for British regiments, and to report upon the quantity and quality of such as are available for export. The matter is one of importance to the British government, great difficulty being experienced in finding suitable horses at reasonable prices at home. The commission has, I believe, met with fair success, but no report is yet issued. It is stated that in many parts of the country the American dealers have formed a "ring!" A northwest ranche-owner stated lately in London, England, that he could land suitable horses in England at £15 a head without loss. The price paid by government is now £40.

E. N.

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REVIEWS.

"History of the Parsis."

The above title indicates the character of the work to which it gives name. It was published in 1884; but I have not met with a review of it. The people called Parsis are a small exiled branch of the great Persian race,—a remnant that clung to the Zoroastrian faith of their fathers, and, in the eighth century of the Christian era, fled to India to escape the persecution of their apostate countrymen, the great mass of whom had become followers of Mohammed. They were the sect whose struggles have been immortalized in Moore's poem, "The Fire Worshippers." Some few adherents of the old creed remained in Persia, and, in spite of oppression, have survived as a petty cultus to this day; but the remnant which fled to the East form the purest and most enlightened branch of the venerable sect; yet they do not to-day number much over a hundred thousand souls. The work I have named, which comprises two good-sized volumes, is the production of a Parsi of rank and of finished European education, whose use of English is better than that of many a writer who speaks it as his native tongue. This Oriental gentleman has written other books in the same language, and has filled high positions in the British Empire of India, where he is known as Dosabhai Framji Karaki. The sight of this long hard name on a title-page starts in us the notion that a new branch of literature in our language is budding into life, and that early in the next century no small number of books by our distant Aryan cousins of the far East may claim and command attention in the West. If I am not mistaken, a defence of the Mohammedan faith by a Hindu Mussulman appeared in English a few years ago.

The work I am now briefly reviewing, and of which my limits afford no sufficient room for a full outline, is written with ability, and, so well as I can judge, with candor and truth. It gives a synopsis of the history of Persia and its old religion from the earliest times; but is mainly devoted to narrating the fortunes, describing the manners and customs, defining the faith, and exhibiting the character of the Parsis of India, who, I believe, on the testimony of others than their countryman, to be the finest race found in the British Empire of the East. One singularity in their modern development is that, like the Jews, though descended from a warlike ancestry, they have in later times contrived generally to avoid taking part in the wars in which the people among whom they dwelt were often engaged; though when self-preservation compelled the Parsis to take such part, their blows were effective and at times decisive. In both cases the non-military spirit was probably due in part to the same cause—social and political isolation,—which disidentified them with the realms they lived in, and prompted some mode of buying exemption from service in the field. The Parsis

are now the most loyal and trustworthy native subjects which Empress Victoria has in India; yet none of them are found in her native regiments. This fact, however, as existing at present, our author attributes very rationally to the fact that the skill of even the poorest of the Parsis in the arts of Peace, in most of which they excel all other natives, relieves them, where there is no conscription, of any need of taking to the duties of War for a livelihood. By those useful arts and safe occupations they can gain more than the meagre pay allowed to the native troops could afford.

In another respect the Parsi has undergone, since old times, the same change which has overtaken the Israelite. Though both are descended from progenitors who were mainly pastural or agricultural, they have both taken to less rural occupations, and are mostly dwellers in cities and towns. The Hebrew has become almost wholly commercial or financial in his pursuits, and the Parsi commercial, financial, or mechanical. This change was forced upon the Jew because he was nowhere permitted to become a land-owner; and the traditionary feeling of one whose ancestors tilled every one his own croft, which God alone could take from him and his, prevented the Jew from becoming a farm tenant; and such tenantry, moreover, was a lot most open to bigoted oppression. The Parsi in his new home was less under compulsory force than the Jew. The Parsi was free to own land; but in his new home the tillers of the soil formed a low caste to which he had no wish to assimilate, while his versatility and mechanical skill offered him a better livelihood than he could gain as a cropper of rice or millet. The Jew and the Parsi left old pursuits for new from a motive which has prompted many a less justifiable change,—because they could do better by it.

The chief source of interest which I feel in the work before me is the history and delineation of that ancient monotheistic faith which is perhaps as old as that of Moses, and which in later times exerted a strong and benign influence on the latter. The creed of Zoroaster, notwithstanding its dualistic form, is monotheistic; for it recognizes but one God of Goodness, Ormuzd, while Ahriman, the Evil Principle, is not a being of divine rank, but one to be hated and feared, not adored. During the Jewish captivity that evil being, under the new designation of Satan, the Adversary, and with dignity curtailed, made his way into Hebrew mythology; but along with him came the Persian hope of an immortal future, which Moses had ignored. The first-named acquisition did the faith of Israel no harm; for it pushed out of entity the heathen gods, which had before been, not stocks and stones, but personal realities,—rivals of the jealous Jehovah. The latter acquisition did a vast deal of good. The two acquisitions enabled Judaism to become the mother of Christianity.

The author defends none of the positive superstitions of his sect, but he defends the so-called fire worshippers from the charge of idolatry and fetishism. The visible flame which God created is not an image, nor is it worshipped as a fetish or thing of magical qualities, or as an imaginary divinity or prodigy of any kind. To use sacramental phraseology, it is "an outward and visible sign," not "of an inward and spiritual grace," but of an unseen power,—of its Mighty Kindler, who alone is adored. To the earliest fire worshipper, long before the days of Zoroaster, that flame was probably a "real presence," under the belief that the element of light and heat, which vivifies all creation, was the actual Creator,—was GOD; and, if so, that notion of primitive man was perhaps an effort of primitive philosophy, in which a fraction of truth may still be recognized. However this may be, Zoroaster did right in converting into a type what his forefathers viewed as a reality.

The Zoroastrian sect never encouraged polygamy, which has long been replaced by a reasonable facility for divorce and monogamous remarriage. The moral aspects of the faith, during its long existence, if we take into account all adverse as well as

favorable influences, will probably compare reputably with the moral effects of any other monotheistic creed. It is my belief that at this day it exerts a better influence on the mass of its followers than is done by either Judaism, Moslemism, or Asiatic Christianity. If it has not in this respect risen as high as Western Christianity, we must remember that it has not been lifted by the enlightenment of the West. We often hear that Christianity has civilized Europe; but few call to mind how much Europe has done towards civilizing Christianity.

The history of any extensive and long-lived sect reminds us of how much the fortunes of war have had to do with the fortunes of religious belief and worship. Gibbon, in commenting on the consequences of Charles Martel's victory over the Saracens near Poitiers, a victory which apparently saved Western Europe from sharing the fate of Greece, observes that but for the results of that battle Mohammedan doctors of divinity might now be expounding the Koran at Oxford. If I may here speculate in a similar way on what might have been, I may venture to say that had the Persians won the battle of Marathon, the gods of Greece, in spite of their artistic and poetical merits, would have gone down; and the power of the sword might have spread over Europe, and consequently over the New World, a religion more monotheistic than the worship of the Holy Trinity. If so, there might have been at this day a shrine of Ormuzd and the sacred flame where Trinity Church now stands; yet I doubt if that shrine would have looked down Wall Street with any stronger moral influence than Trinity clock does now,—and we know that the aforesaid clock occasionally strikes three with very demoralizing effect. R. M. P.

Reed's "Topographical Drawing and Sketching."*

This work, intended as a text-book for beginners in the art of topographical drawing and sketching, is admirably suited to its purpose. Experience in teaching has made the author familiar with the requirements of the student, and he has written exactly as he would teach. The special charm of the work is the simplicity of its language. The writer indulges in no didactic eloquence, but explains and describes as if he meant to be understood; and the minutest detail, down to the very sharpening of a pencil, receives attention. The work is text-book and teacher combined.

The work is divided into VII. parts, has an elaborate table of contents, an appendix of useful tables, and XXVI. explanatory plates.

Part. I. is devoted to descriptions of instruments and materials, and the preparatory operations essential to successful work at the drawing-board. It contains in clear and concise language the instructions which the author, no doubt, has been obliged to repeat orally, over and over again, not only to successive classes at the Academy, but to every member of the same class. With this text-book in the hands of the students, these tiresome repetitions will be unnecessary.

In Part II., which treats of topographical drawing, the text and plates leave little to be desired, except it be that they occupied adjacent pages. There is nothing more annoying to a student than the necessity of turning to plates and references in some other part of the book. The English language ought to be equal to any general description, and when, in special cases, it becomes necessary to resort to graphic illustrations, detailed explanations of them should be given on the plate. The student would certainly appreciate such an arrangement.

In Part III. the subject of topographical drawing in colors is lucidly treated; and in Part IV. the copying, reduction, and enlargement of maps. Nothing seems to have

* "Topographical Drawing and Sketching, Including Applications of Photography." By Lieut. Henry A. Reed, U. S. A. New York: John Wiley & Sons, 1886.

been overlooked in these parts. The student is taken by the hand, as it were, and led over or around every possible difficulty.

The various methods of map projection in geodetic surveying are explained in Part V. with the clearness and accuracy which characterize all the author's descriptions, and with a conciseness which enhances their value to the student.

Topographical sketching, to which Part VI. is devoted, is a difficult subject to teach. Nevertheless the author manages to make it appear simple enough. He divides it into three distinct operations, namely, *Constructing the skeleton*, *Filling in the details*, and *Hill sketching*; and after describing the instruments used, proceeds to explain how these operations are performed. As we read we are struck with the simplicity and accuracy of the methods described. They are simply the methods of a regular survey hastily executed with hand instruments, and rapidly plotted and filled in, preferably on the spot. They certainly should be approximately accurate and easy to read. Still experience teaches that such sketches, even when executed by accomplished surveyors and draughtsmen, are not infrequently very difficult to read. On the other hand some men, born caricaturists of topography, can in an easy off-hand manner, and in an incredibly short space of time, produce a topographical sketch which, although full of exaggerations and almost empty because of omissions, will convey to a third party not only an accurate idea of the country represented, but impress its features on his mind so distinctly that he will be able to recognize them at once when he sees them. They are in drawing what some of Mark Twain's sketches are in literature, truer than the truth.

The application of photography to topographical sketching is comparatively new in this country, and it is gratifying to find it taking its place alongside of older and generally accepted methods. The possibilities in this direction are immense, as a perusal of Part VII. of the work before us will disclose.

The Appendix contains some useful tables; and the plates, among which we recognize some old acquaintances, are creditably gotten up. Indeed the whole work is an excellent one, and we expect to see it take its place as the recognized American text-book on topographical drawing and sketching. C.

Nov. 2, 1886.

The Museum of the MILITARY SERVICE INSTITUTION has received from Colonel Geo. L. Gillespie, Corps of Engineers, U. S. Army, a piece of oak lately taken from the wreck of the British man-of-war "Somerset," wrecked off Cape Cod in 1778.

The "Somerset," a third-rate man-of-war, of 64 guns, was built at Chatham, May, 1746, launched on the 18th of July, 1748, and fitted as a guard-ship. She was so employed until 1774, when she left England for North American service. In 1776 she returned to England and again served as a guard-ship. In 1777 the "Somerset" joined the British squadron at the siege of Boston. At the battle of Bunker Hill she stormed the fortifications in the early morning, and afterward covered the landing of the British. During the following year she remained about Cape Cod and the adjacent shores, capturing and burning much of the American commerce. In November, 1778, when the British squadron was in hot pursuit of the French fleet, the "Somerset" found herself on a lee shore; struggling to weather the Cape, she "missed stays," and drifted helplessly in the trough, and struck upon the outer bar of Cape Cod. At high tide, a succession of great waves lifted the frigate from the bar, bore her over the intervening shoals, and landed her, a dismantled wreck, high upon the beach.

The guns were removed by the Americans and utilized in the fortifications at Gloucester and on the coast of Maine.

FOR REVIEW.

Notes on Experiments with High Explosives. By M. M. Macomb, 1st Lieut. 4th Art. (Fort Monroe, Va.) 1886.

Comparisons of the Armaments of European Nations, Describing their Systems of Artillery. By A. D. Schenck, 1st Lieut. 2d Art. (Fort Monroe.) 1886.

An Historical Account of the Development of Small-Arms and Ammunition, etc. By C. A. Bennett, 2d Lieut. 3d Art. (Fort Monroe.) 1886.

Field-Surgeon Duties of the Care of Wounded in Battle. By Lieut.-Col. J. R. Smith, U. S. A.

Military Geography of the Dominion of Canada. By A. D. Schenck, 1st Lieut. 2d Art. (Fort Monroe.) 1886.

Defensive and Offensive Weapons and Engines of the Ancients, etc. By J. R. Williams, 1st Lieut. 3d Art. (Fort Monroe.) 1886.

General Arrangement and Practical Working of the Artillery Defence of First-Class Coast Fortress, etc. By Major A. W. White, R. A. (Woolwich.) 1886.

Admiral Blake. By David Hannay. (New York.) D. Appleton & Co. 1886.

Katy of Catoctin; or, The Chain Breakers. By G. A. Townsend. (New York.) D. Appleton & Co. 1886.

Topographical Drawing and Sketching, etc. By Lieut. H. A. Reed, U. S. A. (New York.) J. Wiley & Sons. 1886.

The two Spies, Nathan Hale and John André. By Benson J. Lossing. (New York.) D. Appleton & Co. 1886.

The Volcano under the City. By a Volunteer Special. (New York.) Fords, Howard, & Hulburt.

IN EXCHANGE.

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THE STATUE OF LIBERTY.

1.

Come thy sons, France! in friendship's name,
Across the sea,
With sculptured form, and symbol flame,
Of Liberty.

2.

Ideal form of peerless grace,
Stately and grand,
It comes to find fit resting-place
In Freedom's Land.

3.

The symbol flame; 't is Wisdom's Light,
The guiding ray
Of Liberty, from darkest night
To sunlit day.

4.

Welcome, Blest Liberty! O'er earth,
May thy Light burn,
Till peoples all, the glorious birth
Of Freedom, learn.

5.

When faint and homeless, wand'ring far,
Hither it came,
To rise and glow, like Bethlehem's Star,
A Heaven-lit flame.

6.

Thy children, France! have caught its glow,
Till o'er thy hills,
And through thy vales, its blessings flow
In living rills.

7.

Heaven grant that no iconoclast
Crush Freedom's Life,
Nor Anarchy, our dear land blast,
With cruel strife.

Z. B. TOWER.